



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

JUL 10 1995

REPLY TO THE ATTENTION OF:

**HS-6J**

Jan Carlson  
Chief, Division of Emergency & Remedial Response  
Ohio Environmental Protection Agency  
1800 WaterMark Drive  
P.O. Box 1049  
Columbus, OH. 43266

RE: Five-Year Review for the TRW Minerva Superfund Site, Minerva, Ohio

Dear Ms. Carlson:

The United States Environmental Protection Agency (U.S. EPA) has received the Five-Year Review, developed by the Northeast District Office for the TRW Minerva Superfund site. After evaluating the Five-Year Review, the U.S. EPA concurs with its content, and recommendations. Once the Five-Year Review has been transmitted to TRW, please notify us when you plan on meeting with TRW to discuss the recommendations.

The Ohio Environmental Protection Agency effort and cooperation in developing the Five-Year Review is appreciated.

Sincerely,

A handwritten signature in black ink, appearing to read "Wm. E. Muno", is located below the "Sincerely," text.

William E. Muno, Acting Director  
Waste Management Division

cc: Vicki Deppisch, OEPA-NEDO



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

**SR-6J**

March 10, 1997

Ms. Vicki Deppisch  
Ohio Environmental Protection Agency  
2110 E. Aurora Road  
Twinsburg, OH 44087

RE: TRW Minerva Ten-Year Review

Dear Ms. Deppisch:

I am in receipt of correspondence, dated February 25, 1997, to you from Richard Bell of TRW requesting that the Ten-Year Review be completed in June 2000. As was described in the TRW letter, the Five-Year Review was completed in June 1995, but since the Five-Year review should have been completed in June 1992, the Ten-Year review completion date would be June 1997. After review, the United States Environmental Protection Agency (U.S. EPA) agrees with TRW and would find the June 2000 a more appropriate date for the Ten-Year review. Since the Ten-Year review is being completed as a matter of policy and additional groundwater monitoring data will be available in the year 2000, flexibility is warranted in this case.

If the Ohio Environmental Protection Agency (Ohio EPA) agrees with the June 2000 date for the Ten-Year review, please copy the U.S. EPA on your correspondence to TRW. If you have any questions or concerns, feel free to contact me at (312) 886-7278.

Sincerely,

A handwritten signature in dark ink, which appears to read "Thomas Alcamo", is written below the word "Sincerely,".

Thomas Alcamo  
Chemical Engineer

# **TRW MINERVA 5-YEAR REVIEW**

3860 Union Avenue South  
Minerva, Ohio 44657  
Stark County

OHD 004 179 339

Prepared by:  
Ohio Environmental Protection Agency  
Northeast District Office  
Division of Emergency and Remedial Response  
2110 East Aurora Road  
Twinsburg, Ohio 44087

June 1995

**FIVE-YEAR REVIEW REPORT  
TRW MINERVA (PCC AIRFOILS)**

**I. Introduction**

Purpose

The Ohio Environmental Protection Agency (Ohio EPA) has conducted a Five Year Review of the environmental conditions at the TRW site in Minerva, Ohio in order to evaluate remediation activities conducted at the site to determine whether site conditions are protective of public health and the environment. The remediation activities have been conducted under two separate Ohio EPA Administrative Orders on Consent (Consent order), the first was dated June 5, 1985 and provided for surface soil and sediment cleanup, and the second was dated May 9, 1986 and provided for ground water investigation and remediation. The U.S. EPA was not a signatory to either one of these Administrative Orders.

Remedial investigations at the TRW site began in 1981 following the discovery of polychlorinated biphenyls (PCBs) in soil and sediments. Investigations revealed the presence of volatile organic compounds (VOCs) in ground water below the site. Residual concentrations of VOCs were subsequently detected in site soils and sediments as well. In order to proceed with the site remediation as quickly as possible, TRW and the Ohio EPA chose to separate the resolution of the surface soil and sediment issues (a source remediation problem, concerned with VOCs) from the ground water issues (a chemical migration problem, concerned with VOCs). This approach allowed the remediation of the surface soil and sediment to proceed while continuing with the ground water investigation.

The surface soil and sediment cleanup was carried out in accordance with the June 5, 1985 Administrative Order on Consent after U.S. EPA issued an approval with conditions for a TSCA (Toxic Substances Control Act) 40 CFR Section 761.75 authorization, dated May 31, 1985 and amended August 2, 1985, to conduct a remedial action on the site and allowing for the disposal of remedial wastes into a solid waste secure landfill.

The May 9, 1986 Administrative Order on Consent for ground water investigation and remediation included, as a major component of the remedial action, the installation of a ground water extraction well system. In accordance with paragraphs 5 and 6 of Section V, Work to be Performed, of the Consent Order, TRW was required to examine the effectiveness of the groundwater treatment system by comparing the predicted cleanup concentrations with actual analytical results from groundwater monitoring compliance wells, and then to report their findings to Ohio EPA. Reports prepared in connection with the Consent Order, numerous analytical data from the ground water compliance wells, and historical documents were used in the preparation of this review and recommendations. The TRW site was listed on the National Priorities List by U.S. EPA in 1987.

Ohio EPA also conducted the Five Year Review at the TRW Minerva site at the request of the U.S. EPA. According to U.S. EPA's guidance (OSWER Directives 9355.7-02 and 9355.7-02A), Five Year Reviews are conducted under two circumstances; first, under Section 121(c) of the Comprehensive Environmental Response Compensation, and Liability Act (CERCLA) and Section 300.430(f) (4) (ii) of the National Contingency Plan (NCP) Comprehensive, Statutory Reviews are conducted of sites at which hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure following completion of all remedial actions; and, second, Policy Reviews are conducted of remedies selected prior to the enactment of the Superfund Amendments and Reauthorization Act of 1986 (SARA) or of post-SARA remedies where, upon completion no hazardous substances will remain, but it will take five or more years to reach that point. The remedy at the TRW site predates SARA, which occurred in October 1986. Therefore, the Five Year Review being conducted by Ohio EPA, on behalf of U.S. EPA, is being done as a matter of U.S. EPA policy.

A three tier approach has been established by U.S. EPA for conducting Five Year Reviews. All three types of reviews focus on the protectiveness of the remedy. Site-specific considerations, including the nature of the response action, the status of on-site response activities, and the proximity to populated areas sensitive environmental areas are all factors considered in determining the level of review for a given site. A level I is the most basic type of evaluation of protectiveness

and it is appropriate for most sites. A level II review contemplates a recalculation of risk, if site-specific circumstances warrant. A level III review involves a new risk assessment and is utilized when site specific circumstances show it to be necessary. U.S. EPA requested that a level I review be conducted of the TRW site. This review has consisted of the following elements: (1) a review of all documents associated with the Remedial Action (RA); (2) a site visit; and (3) standards or Applicable or Relevant and Appropriate Requirements Review (ARARs).

### Site Characteristics

The TRW site is located at 3860 Union Avenue S. E., in the town of Minerva, Stark County, Ohio. The plant is adjacent to State Road 183, approximately 1.3 miles northeast of the intersection of Route 183 and U. S. Route 30, as indicated in Figure 1. Farmland is north and east of the site while undeveloped woodlands are to the west. Residential homes are south and southwest of the site. The city of Minerva's municipal well field is located southwest of the site, less than a mile from the site (Figure 2). According to the 1986 Consent Order, the overall site consists of approximately 135 acres which includes the plant site of 54 acres and the additional properties known as the "south property" and the "east property" which are adjacent to the 54 acre parcel (Figure 3). Ground water flow is to the south and southwest.

Located on the 54 acre parcel is the single major building which comprised the Minerva, Ohio, Casting Division facility of the TRW Aircraft Components Group. TRW sold the Minerva facility to PCC Airfoils on June 27, 1986 but has retained responsibility for the surface cleanup/secure cell and ground water remediation projects.

In addition to the plant itself, important features located on the TRW property included a drainage swale running along the eastern and southern borders of the plant; an ornamental lake, West Lake; a discharge stream running from West Lake to Sandy Creek; a drainage lagoon, South Pond; the wax ditch, which runs from the plant to South Pond; and a rubble pile.

In August, 1981, TRW notified U.S. EPA and Ohio EPA of its

discovery of polychlorinated biphenyls (PCBs) in the soils. Significant concentrations were found in some areas of the site. In the swale PCB concentrations ranged from < 1 part per million (ppm) to 1600 ppm. PCB concentration ranged from <1 ppm to 2000 ppm in the South Pond. In the wax ditch PCB concentration ranged from 2000 to 5000 ppm. In the rubble pile the PCB concentration ranged from <1 ppm to 1,000 ppm. In surface soils on the Fry property (owned by TRW) the PCB concentration averaged less than 10 ppm but 2 of 51 samples detected concentrations >10,000 ppm.

Volatile organics were discovered in ground water on and off site in 1984. Volatile organics were used at the TRW site during materials processing and handling. Spent degreasing materials were discharged directly to the wax ditch and flowed into the South Pond. Dredged material from these areas were deposited on the rubble pile. The areas of ground water contamination have been identified as the Barn, Eastern, Central and Southwest Areas and are shown in Figure 4. The major contaminants detected in the water are tetrachloroethene (PCE), trichloroethene (TCE), trans-1,2-dichloroethene (trans-1,2-DCE), 1,1-dichloroethene (1,1-DCE), vinyl chloride (VC), 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethane (1,1-DCA), and chloroethane (CA). Table 1 is a summary of the analytical data for sampling events between June 1984 and April 1986 during the investigation study.

**Barn Area.** Eight contaminants (1,1,1-TCA, 1,1-DCA, CA, PCE, TCE, 1,1-DCE, trans-1,2-DCE, and VC) were detected in three Barn area wells W5s, W4m and 42m. The highest concentration detected was 1,000 ppb of 1,1,1-TCA. Contamination was detected down to bedrock, which at this portion of the site lies at a depth of only 53 feet. The source is unknown.

**Eastern Area.** Low levels (less than 4 ppb) of contamination were detected in ground water at this portion of the site, extending to a depth of 60 feet. 1 ppb of trans-1,2-DCE was detected in well 36m. The same constituent was detected in a residential well at 2 ppb. Vinyl chloride was detected in two other residential wells between 1 and 2 ppb. TRW stated that this contamination probably was not caused by them.

**Central Area.** This was the most extensive area of contamination and contained the highest concentrations of

organic compounds: up to 2,000 ppb of 1,1-DCA in well 13; 1,700 ppb of CA in well 18; and 1,500 ppb of 1,1-DCA, 1,300 ppb of TCE, 1,300 ppb of trans-1,2-DCE, and 190 ppb of VC in well 19/19a. The organic compounds were present in the upper forty feet of the aquifer and decreased in concentration with depth. The source or sources are believed to be the former South-Pond, wax ditch, and rubble pile.

**Southwestern Area.** 1,1,1-TCA, trans-1,2-DCE, and VC was detected in the wells. The highest concentration was 32 ppb of VC in well 35m. The contamination was detected as deep as 90 feet below grade in investigative samples.

A total of 47 monitoring wells were installed on and off site during the ground water investigation (Figures 2 and 5). According to the ground water flow maps for 1988 through 1992 included in the "Five-Year Report for the Groundwater Extraction and Treatment System for the TRW site, Minerva, Ohio" dated June 12, 1992 by Clement Associates, Inc., ground water flow is to the south and southwest (Figures 6-10).

#### Residential Wells

At the time of the investigation many homes south of the site had a residential well for their water supply source. To the southwest and north of Sandy Creek is a residential area known as the Old Park area. The area south of Sandy Creek, bordered to the south and east by the Pennsylvania Railroad is known as the Fry allotments. A total of 50 residential wells were sampled and analyzed. PCBs were analyzed in twelve of the samples. No PCBs were detected in these 12 wells and further PCB testing was not pursued. The main contaminant detected in residential wells was vinyl chloride with a range of 1 to 57 parts per billion (ppb). Other constituents found in the residential wells were DCA, TCA, TCE, and trans-1,2-DCE. Most of the homes with contaminated wells have been connected to the city water system. However, the contaminated wells are still used for "outdoor activities" (car washing, garden watering, swimming pools, etc.) and have not been abandoned. The sample locations and analytical data from the initial investigation are presented in Figure 11 and Table 2. A recent map dated May 6, 1994 (Figure 12) from Dennis Clapper, Service Director, Village of Minerva, indicates the location of

all residential wells that are currently used for a primary drinking water source and have not been hooked up with the city water. Table 3 provides the current owner name for each well. Well logs for most of the area could not be located. However, the logs that were available indicate some wells are in bedrock as well as sand and gravel.

#### City of Minerva Drinking Water Supply Wells

The city of Minerva's municipal water supply is less than a mile downgradient of the TRW site. The city has 4 wells, 3 of which are currently in use. Each well pumps 580 gallons per minute (gpm) but the pumping time varies for each well. The boring logs indicate the wells are in sand and gravel and are 75 to 85 feet deep. Volatile organic testing from the Minerva wells and plant tap has been done quarterly since 1,1-DCE was detected at levels between 2.0 and 4.0 ppb in July, 1989. No volatile organics have been detected in the wells from 1989-1993 from the well or the distribution tap. No volatile organics have been detected in the wells during 1994 from the distribution tap.

#### Hydrogeologic setting

The TRW site is located at the approximate boundary between two physiographic provinces: the unglaciated Allegheny Plateau to the south and the glaciated plateau that extends northward to Lake Erie. The site overlies a northeast-southwest trending preglacial river valley that is filled in with glacial outwash. These permeable materials are overlain by a 5-20 foot layer of clay-rich glacial till. According to boring logs the glacial till material is described as "sand, gravel and clay" or "clay and stones." Significant clay lenses were not encountered in the area. Depth to bedrock is approximately 150 feet below surface along the center of the valley where the Central Area and the Southwestern Area are located, although there are no borings to confirm this depth. In the vicinity of the Barn Area (Monitoring well W4m) bedrock was encountered at a depth of 53 feet, at monitoring well 32m bedrock was encountered at 18.5 feet, and at 131 feet at monitoring well 29m. Monitoring well 32m is the only well screened to the top of bedrock. The screened interval is between 8.5 feet and 18.5 feet. Initial analytical results detected 1 ppb of trans-1,2-DCE in the ground water at well 32m. Bedrock consists of the Pennsylvanian Lower Allegheny or Upper

Pottsville Groups, which are characterized by interlayered units of sandstone, shale, limestone and coal.

#### Ground Water Pump and Treatment system

The conclusions of the site investigations formed the basis of the Consent Order between TRW and the Ohio EPA. The Consent Order required TRW to design, construct, maintain and operate a ground water extraction treatment (GET) system consisting of ground water extraction wells and air stripping of VOCs.

The Consent Order established that the remediation system remain operational until four quarters of monitoring data demonstrate compliance with one (or a combination) of the following performance standards:

- a. Ground water quality meets or exceeds established drinking water standards for the parameters of concern; or
- b. Ground water quality reaches background or  $1 \times 10^{-6}$  cancer risk concentrations for the parameters of concern; or
- c. Ground water quality meets or exceeds alternate concentration limits as established under the procedure set forth in 40 CFR Section 264.94 and OAC 3745-54-94 and as further described in Attachment B of the Order.

The GET system was constructed in 1986. It includes eight recovery wells (RW wells) pumping at a combined rate of 1,200 gallons per minute (gpm). The ground water recovered is pumped to an air stripper located on the TRW property. This system has been in operation since February 1987.

O'Brien & Gere conducted a 24-hour pumping test in July 1991 to assess the recovery system after four years of operation. Time-drawdown data and straight-line graphs from this test, and from a subsequent test conducted in February, 1992, are presented in their Five-Year Report. Values of transmissivity (T) and hydraulic conductivity (K) were calculated from these tests. These values were then input into a two-dimensional analytical flow model called QUICKFLOW, which was developed by Geraghty and

Miller, Inc.

Nine monitoring wells are denoted "compliance wells" and are monitored quarterly, using Method 601, a gas chromatograph method designed to detect volatile organics. Four of the nine wells were selected to characterize levels of organic contamination in the plumes. These monitoring wells are: W4m (Barn Area). 19a and 13 (Central Area) and 35m (Southwestern Area). These wells exhibited the highest concentrations in their respective areas. The other five wells are located at the leading edge of the plumes to determine whether contamination is being contained within the area of influence of the pumping wells; these include well 24s (south of Central Area plume) and wells 34m, 41m and 44s and 44d (surrounding the southwestern plume). On-site compliance wells are W4m, 13b, 19a, and 24s. The off-site compliance wells are 35m, 41m, 44s, and 44d. These wells are located in the residential area south of the site.

## **II. Discussion of Remedial Objectives**

### Surface Contamination

The remedial objective for the surface contamination involved the excavation of soils and sediments contaminated with the highest concentration of PCBs and their placement in a secure, monitored cell on site. Areas where lower concentrations of PCBs were detected were capped with clay. PCBs have not been detected in the monitoring wells surrounding the secure cell according to analytical data and Personal Communication with Tom Alcamo, U. S. EPA, Region 5, (October, 1994). TRW has not done additional PCB testing in wells since the initial investigation.

### Ground Water Contamination

The Consent Order specified that an Alternate Concentration Limit (ACL) could be developed and used as target clean up levels. A "risk assessment" was performed to develop ACLs at the compliance points. Based on this assessment, TRW concluded that development of the ACLs could focus on the most significant of the exposure points, the Minerva City wellfield. Transport modeling was used to develop a relationship between the chemicals at the compliance points and the exposure point (Minerva City wellfield). This

relationship was then applied to "health protective concentrations" to develop ACLs. The ACLs developed for the compliance point wells located on and off the TRW site are listed in Table 4. A separate ACL was adopted for the VC concentrations in the off-site wells. The Consent Order also required that chemical concentrations at the compliance points be predicted at 1, 5, and 10 year intervals. The predicted concentrations are shown in Table 5.

#### Analysis of Ground Water Data

Data derived from the four compliance point wells that yielded contaminated ground water samples (monitoring wells W4m, 13/13b, 19a, and 35m) indicate highly variable levels of contamination, with unexpected trends. (These data, as graphed by Clement Associates, Inc., are provided in Figures 13-16). Table 6 compares 1986, 1991, and 1992 ground water data. Table 7 lists the most recent data from May, 1992 through August, 1994 for monitoring wells W4m, 13b, 19a, and 35m. Table 8 compares predicted 5-year concentrations to 2-12-92 and 8-3-94 data. The following has been summarized:

- \* Organic levels in Well W4m (Barn Area) Appear to have varying periods of increases and decreases since the GET system was installed. The latest data (8-3-94) indicate another upswing trend. Data comparisons to predicted 5-year levels show wide fluctuations but overall the predicted concentrations have not been met. In some cases the method detection limits (MDLs) were too high to evaluate with a lower predicted 5-year concentration figure.
- \* Levels of 1,1-DCA, 1,2-DCE and CA in samples from well 13/13b (Central Area) fluctuated considerably from 1984 through 1988, but settled to generally lower levels in 1989. The contaminant levels appear to continue to surge and ebb with no general increasing or decreasing trend. The data indicates wide fluctuations. overall the 5-year predicted concentrations have not been met.
- \* Other than one detection of high levels of TCE (almost 1,400 ppb) in monitoring well 19a (Central Area) in 1987 levels of organics in that well have generally

decreased over time. Some constituents have met the predicted 5-year concentrations.

- \* Levels of VC in samples from well 35m decreased until 1987, then increased, hitting a peak of about 75 ppb in November 1990. Since then there has been an overall decreasing trend. The 5-year predicted concentration for VC has been met for this well.

Predicted contaminant levels in the highly contaminated wells W4m, 13, 19a, and 35m after 5 years of extraction have not yet been met in four of the five wells. Monitoring wells 24s, 34m, 41m, 44s, and 44d have met the 5 year predicted concentration of <1 ppb.

#### Analysis of Ground Water Treatment Extraction System

The adequacy of the GET system to contain contaminated ground water cannot be thoroughly evaluated from the information presented to-date. Generally, O'Brien & Gere and Clement Associates, Inc. did not provide explanations or justifications for the analytical techniques chosen for this work. The assumptions inherent in the chosen techniques were not discussed. The capture zone in the Southwestern Area (Figure 17) due to recovery wells RW-3 and RW-1 is not aligned with the apparent plume (Figure 4).

If the alignment of the southwestern capture zone is correct, then contaminated ground water detected in samples from well R-2 may conceivably not be captured by any of the recovery wells. Well R-2 is located in the residential area north of Sandy Creek and south of Delmar Drive. This well, which is screened at a depth of 17-27 feet, yielded samples with 4 ppb of VC in 1986, 84 ppb of VC in 1991, and 3 ppb of trans-1,2-DCE and 38 ppb of VC in 1992. Thus it provides the most contaminated samples of any well in the Southwestern Area, but it is on the boundary of the capture zone. Given the uncertainties inherent in modeling and the scale involved, it cannot be assumed that ground water on this boundary is in fact being captured by the recovery wells.

The data provided in the Five Year Reports and quarterly ground water sampling data indicate wide swings in contamination levels with varying short-lived trends. The expected steady decrease in

aquifer contamination levels is not borne out by these data. The GET system is working; however, it may not be working optimally.

### **III. Site Visit**

A site visit was conducted on September 21, 1994 with Rick Bell and Mark Murphy, TRW Inc., Tom Alcamo, U. S. EPA Region 5, and the author of this report, Vicki Deppisch, Ohio EPA. The site visit consisted of document review and an update on current conditions, a tour of the secure cell and all monitoring well locations, and an overview of the air stripper and ground water extraction system. Maintenance items on the ground water pump and treat system are resolved on a continuing basis throughout the year.

### **IV. Applicable or Relevant and Appropriate Requirements Review**

Five-Year Review guidance established policy for U.S. EPA to review and analyze the remedial action at a site as it is affected by newly promulgated or modified Federal and State environmental laws, Applicable or Relevant and Appropriate Requirements (ARARs) associated with the construction and long-term maintenance and monitoring of the remedial action at the TRW site were not (except for MCLs) addressed in the Consent Order because the Consent Order pre-dates (SARA) establishment and use of ARARs. The remedial action must meet all identified applicable or relevant and appropriate Federal and State requirements. ARARs for the site remedy are as follows:

1. Safe Drinking Water Act (SDWA), 40 CFR Parts 141-143. Establishes Maximum Contamination Levels (MCLs) for ground water remediation.
2. Ohio Revised Code (ORC) 6109 and Ohio Administrative Code(OAC) 3745-81 Drinking Water Standards.
3. National Pollution Discharge Elimination Permit. Ohio Permit Number 31D00060\*BD (effective 12-1-92, expires 11-27-97).
4. ORC 6111. Prohibits pollution of waters of the state of Ohio.

5. OAC 3745-33. Ohio NPDES permits.
6. OAC 3745-1. Ohio water quality standards.
7. Ohio Air Permit To Install (PTI) 15-357 issued April 22, 1987, Premise number 1576151574 (source identification-air stripper).
8. OAC 3745-31. Ohio Air Permits to Install New Sources.
9. Clean Air Act for air stripper requirements.
10. Clean Water Act for NPDES discharge requirements.
11. Toxic Substances Control Act (TSCA) 40 CFR Section 761.

Table 4 identifies the ACLs and MCLs for the TRW Minerva site.

Data analysis indicates TRW has generally been in compliance with the NPDES permit. There does not appear to be any significant permit compliance problems.

The Ohio EPA Ecological Assessment Section evaluated the Sandy Creek in 1993 for a biological and water quality study. The report states: "Biological communities were in full attainment both upstream and immediately downstream from the TRW ground water discharge. No detectable impacts were observed in chemistry, sediment, or fish sampling. The TRW Minerva discharge did not appear to impact water quality."

TRW has been in compliance with the air permit.

## **V. Recommendations**

1. The ACLs established through the Consent Order are normally granted through a RCRA permit application and must demonstrate that the hazardous constituents detect in the ground water will not pose a substantial present or potential hazard to human health or the environment at the ACL levels. The 19 factors, or criteria, that are used to evaluate ACL requests are listed in Section 264.94(b) of the regulation must be adequately discussed by the facility. The U. S. EPA OSWER Directive 9481.00-6C/EPA/530-SW-87-017

Alternate Concentration Limit Guidance, Part 1, ACL Policy and Information Requirements, Interim, Final, dated July 1987 provides further guidance on establishing ACLs. The Supplemental Groundwater Feasibility Study by Clements Associates, Inc. (November 1986) states  $10^{-6}$  risk level would be used to develop clean-up levels at the Minerva site. This was not adequately demonstrated in the risk assessment submitted as part of this document. Based on the data used to establish Maximum Contaminant Levels (MCLs) in drinking water under the Safe Drinking Water Act and the State of Ohio ORC 6109 and OAC 3745-81 Drinking Water Standards the MCLs should be used as the cleanup standards for ground water. If no MCL exists for a specific constituent "Risk Assessment Guidance for Superfund" (RAGS) should be used to calculate and demonstrate that the risk levels are  $10^{-6}$ .

2. The Consent Order states the GET system shall be operated until four quarters of monitoring data demonstrate compliance with one (or a combination) of the performance standards (background, MCLs, and/or ACLs). Due to the ground water usage, the known contaminants, the residual contaminated soils left in place, data fluctuation patterns, the geology, etc. the levels may fluctuate and increase once the GET system is turned off. A long term ground water monitoring program should be designed and implemented to monitor the contaminant levels and detect and prevent any contaminant migration. This would consistently re-evaluate the operational need of the GET system at the site. Additional information may be required for evaluation.
3. To evaluate and ensure that the remedial action implemented remains protective of public health and the environment the following recommendations should be discussed:
  - (a) Contamination has been detected to bedrock. Vinyl chloride has reportedly been detected in ground water at depths of ninety feet in the aquifer near well 35m. There are no monitoring wells screened at a depth of greater than sixty feet. None of the extraction wells are completed at depths greater than 75 feet. There are no bedrock wells to monitor and detect potential contaminant migration.

Comparison of trends noted in deeper wells (not bedrock) to trends noted in the shallow wells may indicate residual contamination in the vadose zone may be a plausible explanation for the variability of data. There are only very shallow wells in the Central Area and the Barn Area and hence, cannot monitor this trend.

There are no compliance wells that regularly monitor the southwest edge of the plume or the Eastern Area which would verify that the contaminants are being contained and the GET system is working efficiently. The compliance monitoring system should be re-evaluated.

(b) To protect Minerva's water supply from any potential ground water contamination, a monitoring system should be designed and installed to detect any contaminant migration.

(c) The GET system should be re-evaluated. A detailed description of the model (QUICKFLOW) should be submitted to OEPA for review. Such a description should address components of the modeling process presented in Figure 18.

(d) Capture zones should be re-evaluated. TRW needs to determine whether ground water passing through the area monitored by well R-2 is likely to enter the city well field and how this potential problem should be addressed. Monitoring well 24s does not appear to be within a capture zone. This should be verified.

4. Compliance wells should be established and monitored regularly along the southwest edge of the plume. All plume boundaries should have a sufficient number of monitoring wells to verify that the plumes are being contained and the GET system is working efficiently.
5. All monitoring wells should be sampled once a year for volatile organic compounds. Static water levels and a ground water flow map should be included with the data.

The surface cleanup order left residual PCB contaminated soils at depth on site. For the next sampling event for all monitoring wells, PCBs and metals should be added to the parameter list (lead was detected in well 19 at a level of

80 ppb on 10-4-84 and PCBs have not been analyzed since 1985).

6. All residential wells, as shown in Figure 12, that are used for a primary source of drinking water should be sampled for volatile organics, PCBs and metals.
7. All residential wells that have been hooked up with Minerva city water should be properly abandoned unless used for monitoring purposes. If used for monitoring purposes the wells must be locked. The wells must be abandoned according to Stark County Health Department's well abandonment procedure.

## **VI. Statement of Protectiveness**

**Surface Soil and Sediment Cleanup:** The secure cell appears to meet the objectives of the Consent Agreement as intended. The ground water monitoring wells surrounding the cell do not show a release to the environment.

**Ground Water investigation and Remediation:** The ground water pump and treatment system is working but may not be working optimally. The above modifications should be implemented to provide adequate protection to public health and the environment.

## **VII. Next Review**

The cleanup standards may not be reached by the next five-year review in 1999. This five year review is anticipated to be a Level I review, consisting of a review of all recent ground water monitoring data and newly promulgated environmental laws.

## REFERENCES

Clement Associates, Inc., Amended proposed Groundwater Treatment Feasibility Study for the TRW Site in Minerva, Ohio, December, 1984. Clement Associates, Inc., Characterization, Risk Assessment and Remedial Action Plan for a PCB Spill at the TRW Site in Minerva, Ohio, Volume I, June, 1983.

Clement Associates., Inc, Characterization, Risk Assessment, and Remedial Action Plan for Volatile Organic Contamination at the TRW Site in Minerva, Ohio, August, 1984.

Clement Associates, Inc., Enclosures to Letter of December, 20, 1983 from Mr. William R. Phillips (TRW) to Mr. Basil G. Constantelos (USEPA), December, 1983.

Clement Associates, Inc., Five-Year Report for The Groundwater Extraction and Treatment System for the TRW Site, Minerva, Ohio, June, 1992.

Clement Associates, Inc., Groundwater Remedial Investigation and Feasibility Study Report for the TRW Site in Minerva, Ohio, Final Report, April, 1985.

Clement Associates, Inc., Supplemental Groundwater Feasibility Study for the TRW Site, Minerva, Ohio, Volume I-III, November, 1986.

O'Brien & Gere, Addendum - Groundwater Treatment Conceptual Design Report, TRW, Minerva, Ohio, July, 1985.

O'Brien & Gere, Five-Year Report for the Ground Water Remediation System, June, 1992.

O'Brien & Gere, Groundwater Treatment Conceptual Design Report, TRW, Minerva, Ohio, July, 1985.

O'Brien & Gere, Preliminary Engineering Design, Minerva, Ohio Site, December, 1983.

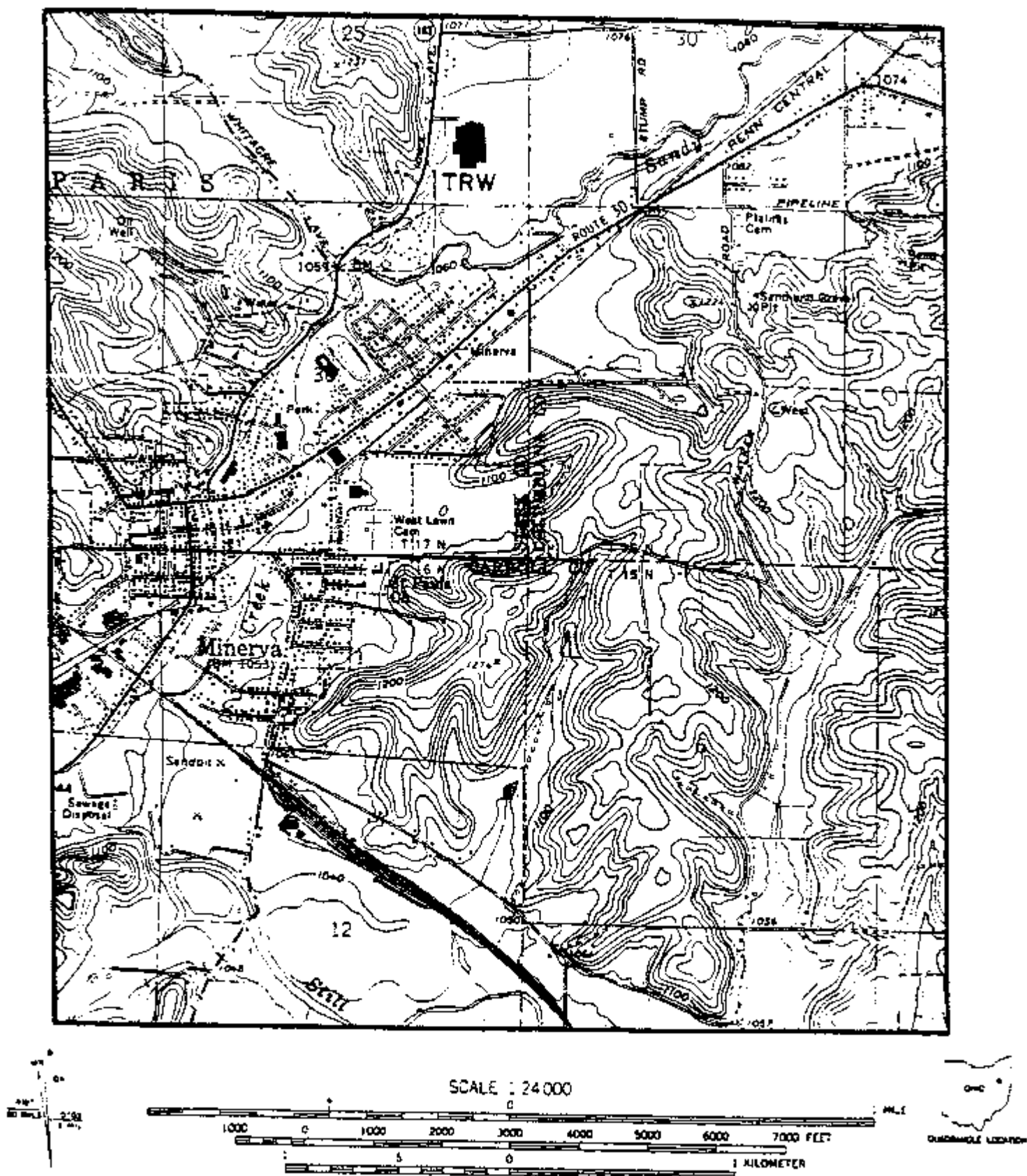
O'Brien & Gere, TRW Surface Remediation, Minerva, Ohio, letter to David Petrovski, USEPA, May 8, 1985.

Ohio EPA, Ecological Assessment Section, Division of Surface Water, Biological and Water Quality Study of Sandy Creek and Still Fork Sandy Creek, Columbiana, Carroll and Stark Counties, Report #EAS/1994-6-4, February, 1994.

U. S. EPA, Office of Solid Waste, Waste Management Division, Alternate Concentration Limit Guidance, Part 1, ACL Policy and Information Requirements, Interim Final, OSWER Directive 9481.00.6C, EPA/530-SW-87-017, July, 1987.

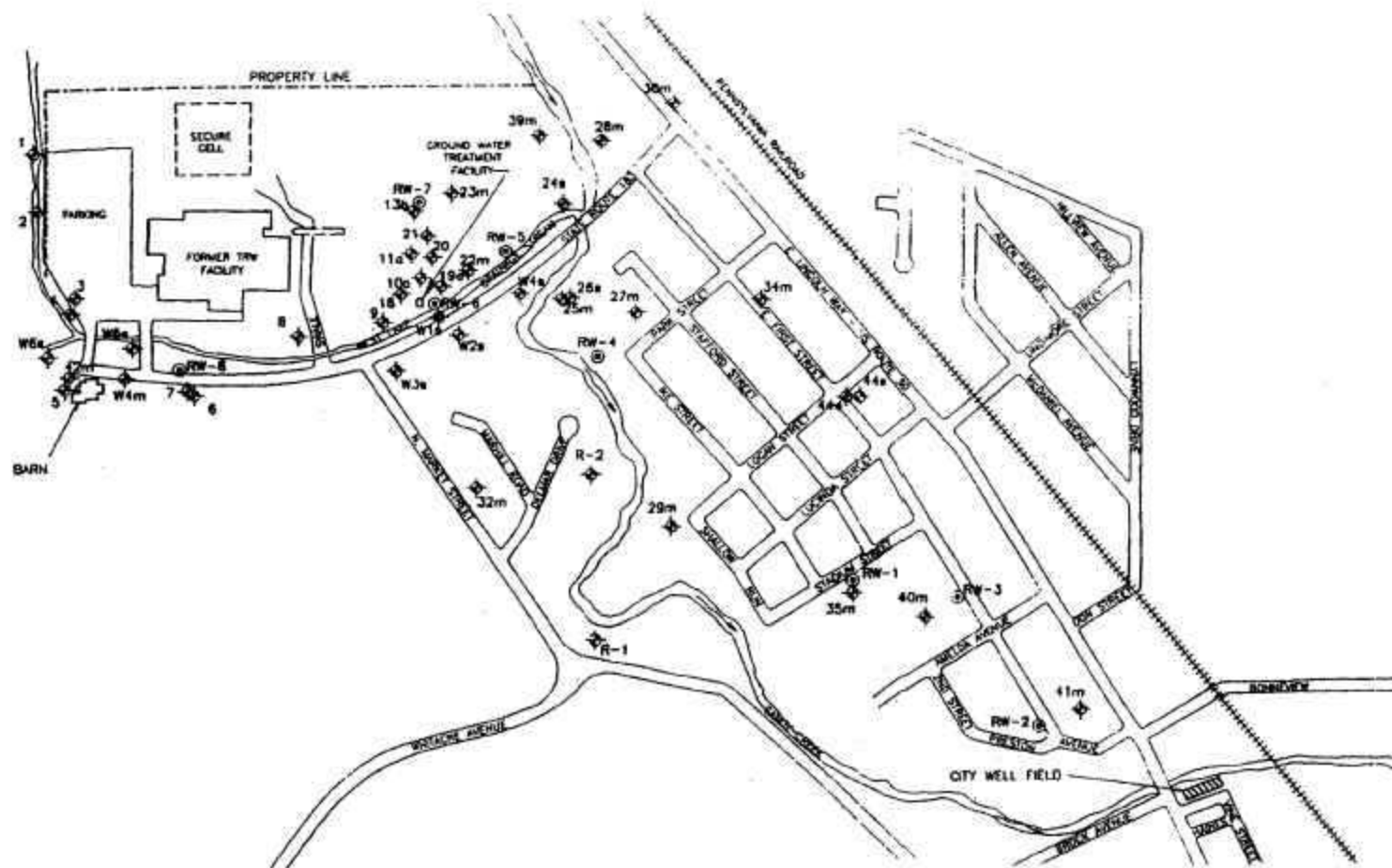
## FIGURES

FIGURE 1  
LOCATION OF THE TRW SITE IN MINERVA, OHIO



(From Clement Associates, Inc., April, 1985)

FIGURE 2  
TRW INC.  
MINERVA, OHIO



LEGEND

- ◆ MONITORING WELL LOCATION
- ⊙ RECOVERY WELL LOCATION

SITE MAP

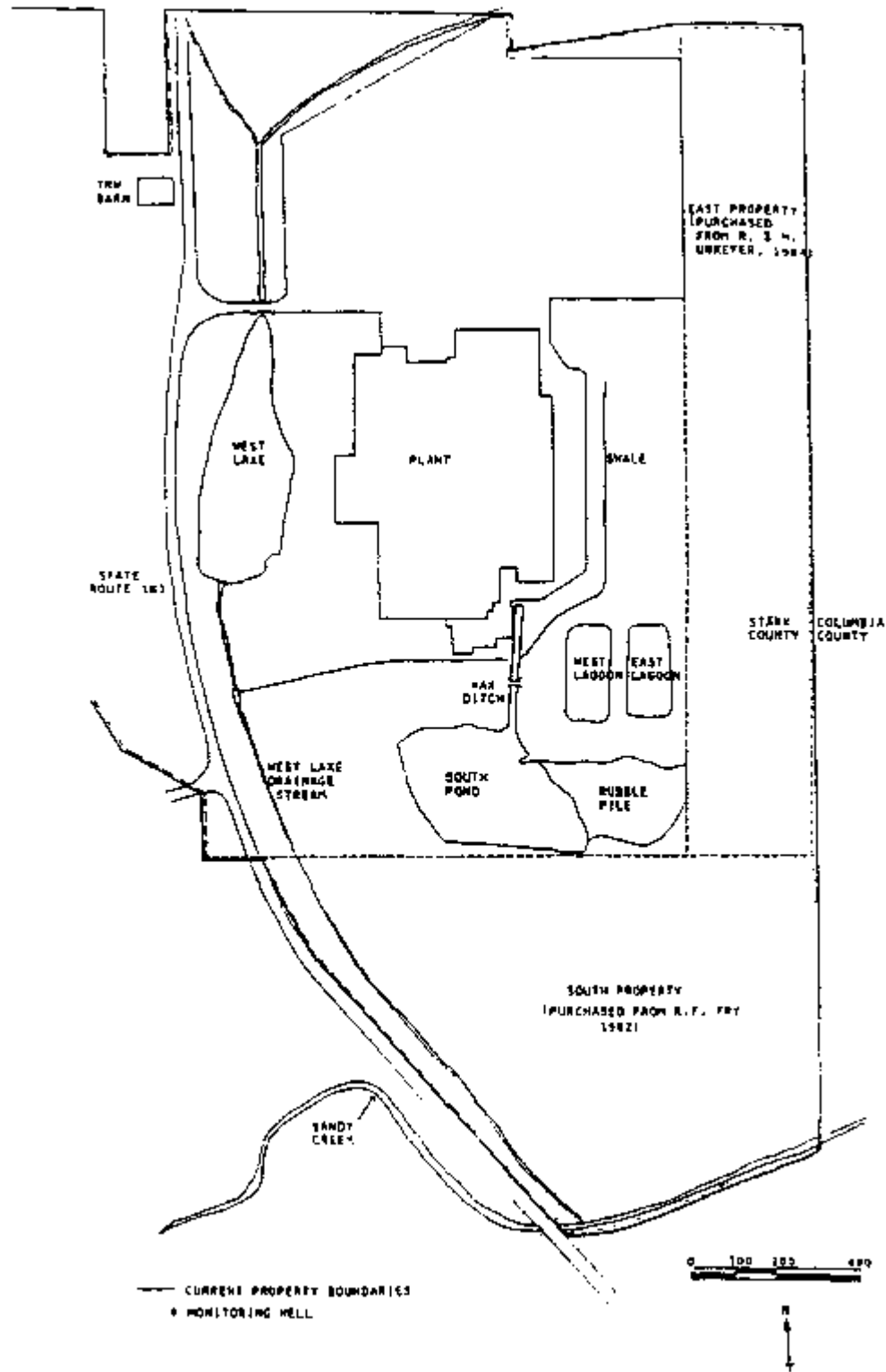


2795.213.320

(From O'Brien & Gere, June, 1992)

FIGURE 3

EXTENT OF GROUNDWATER CONTAMINATION  
TRW SITE, MINERVA, OHIO



(From Clement Associates, Inc., April, 1985)

**THE PROPERTY LINE**

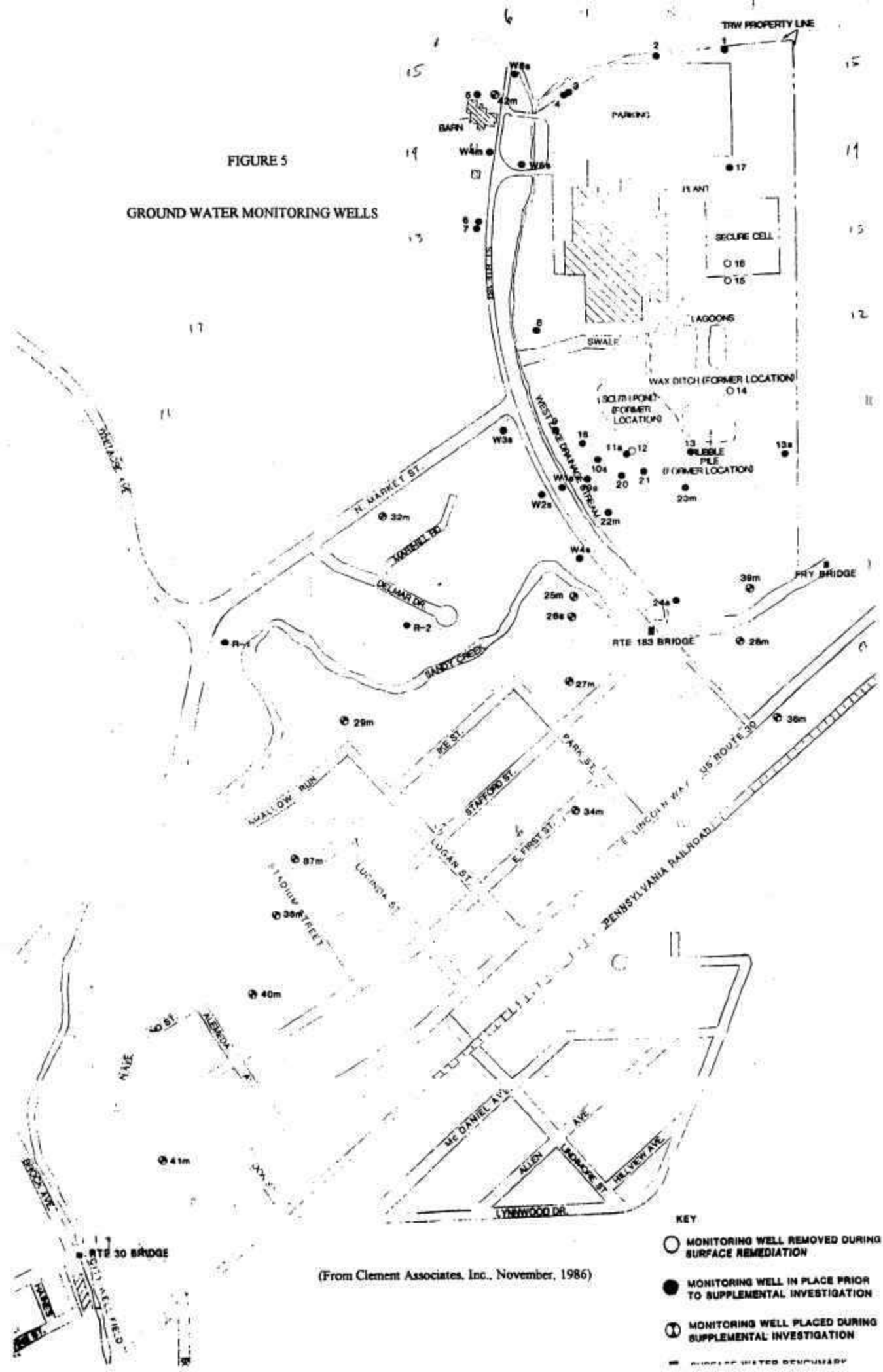
~~SECRET~~      ~~CONFIDENTIAL~~      ~~CONFIDENTIAL~~

            Bureaucracy of Revolutionary Armed  
            Forces of Colombia  
            of Revolutionary Communist

SCALE: 1" = 400'

FIGURE 5

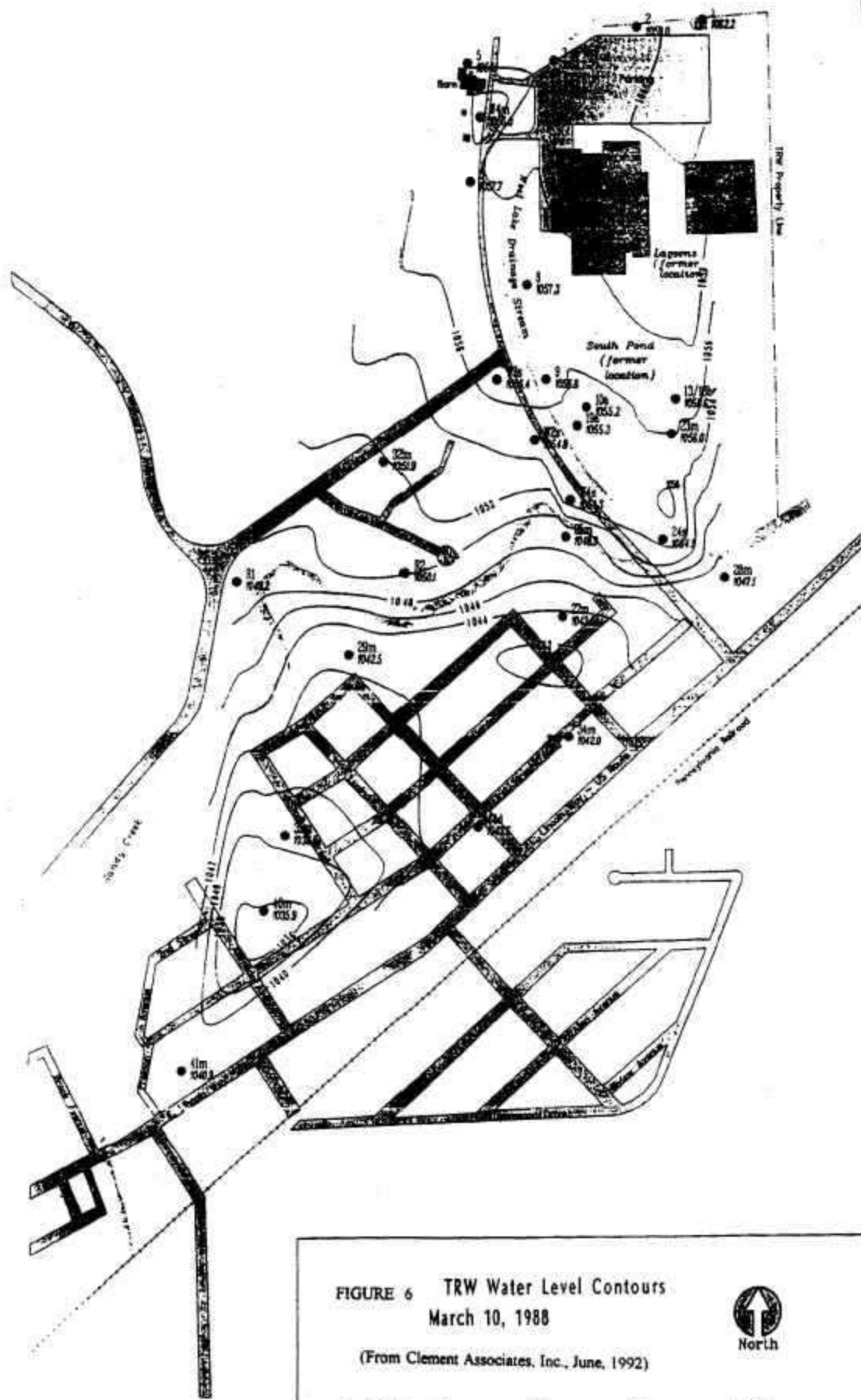
GROUND WATER MONITORING WELLS



(From Clement Associates, Inc., November, 1986)

KEY

- MONITORING WELL REMOVED DURING SURFACE REMEDIATION
- MONITORING WELL IN PLACE PRIOR TO SUPPLEMENTAL INVESTIGATION
- ① MONITORING WELL PLACED DURING SUPPLEMENTAL INVESTIGATION
- SURFACE WATER BOUNDARY



(From Clement Associates, Inc., June, 1992)



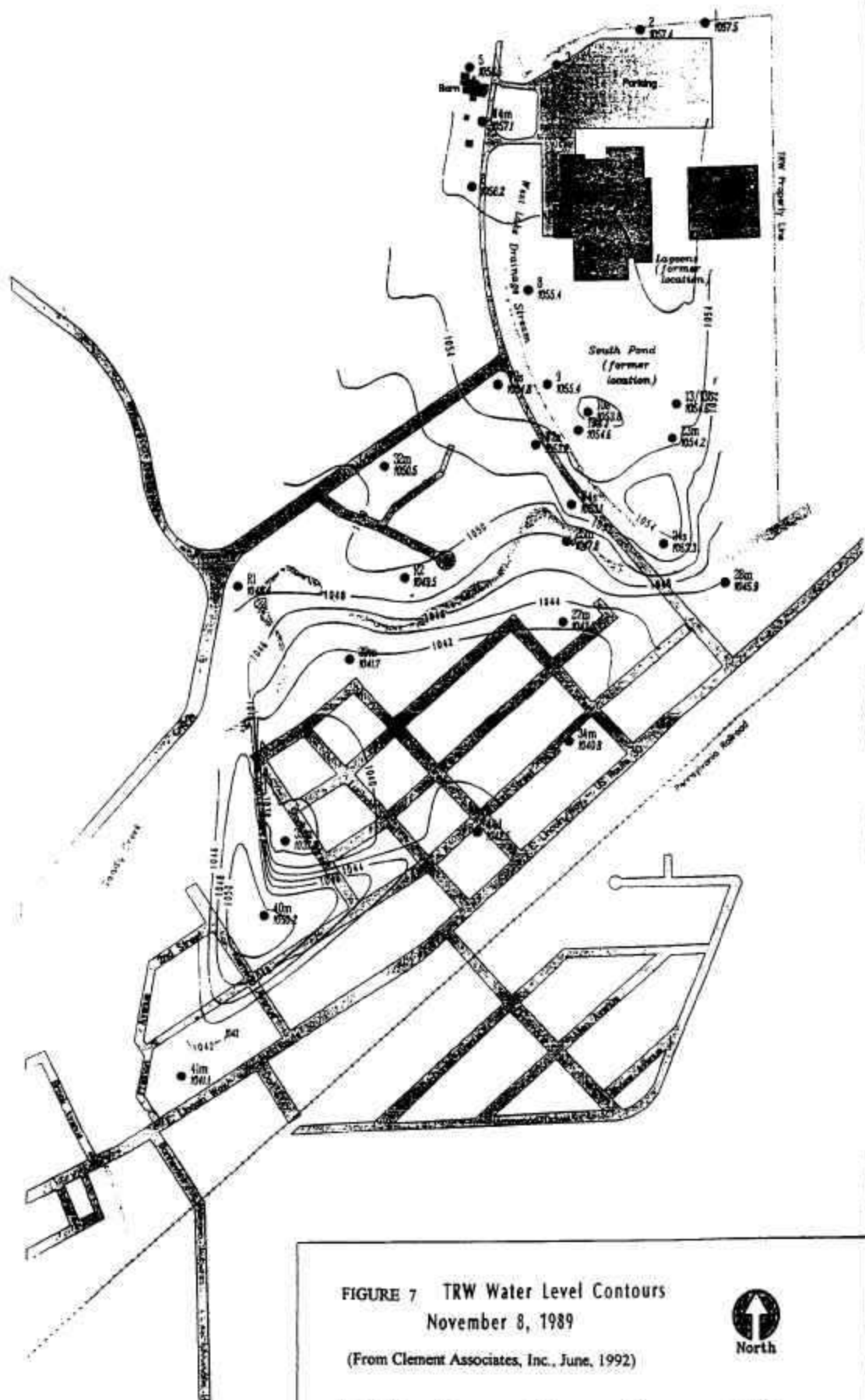
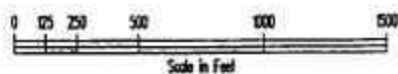
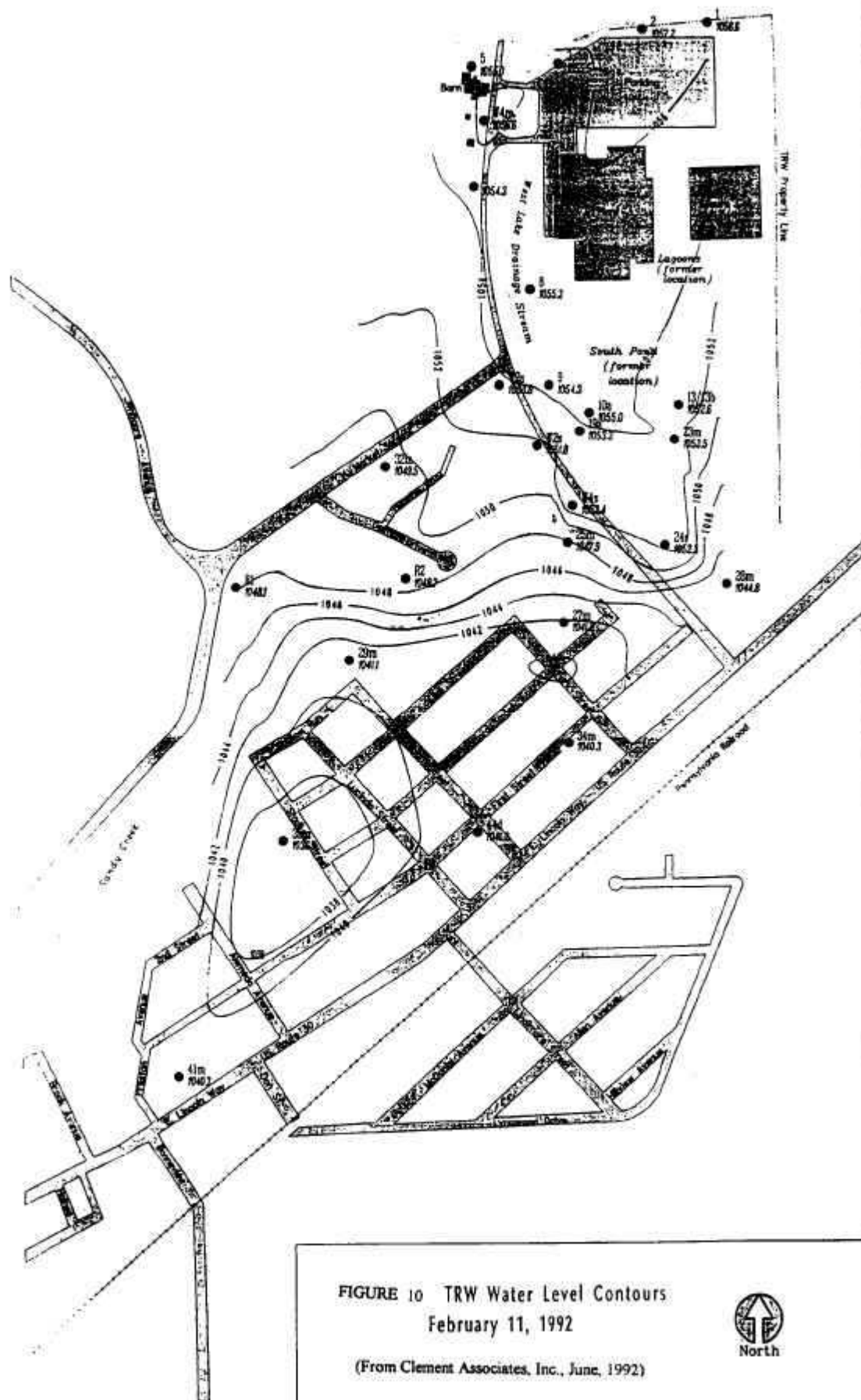


FIGURE 7 TRW Water Level Contours  
November 8, 1989

(From Clement Associates, Inc., June, 1992)







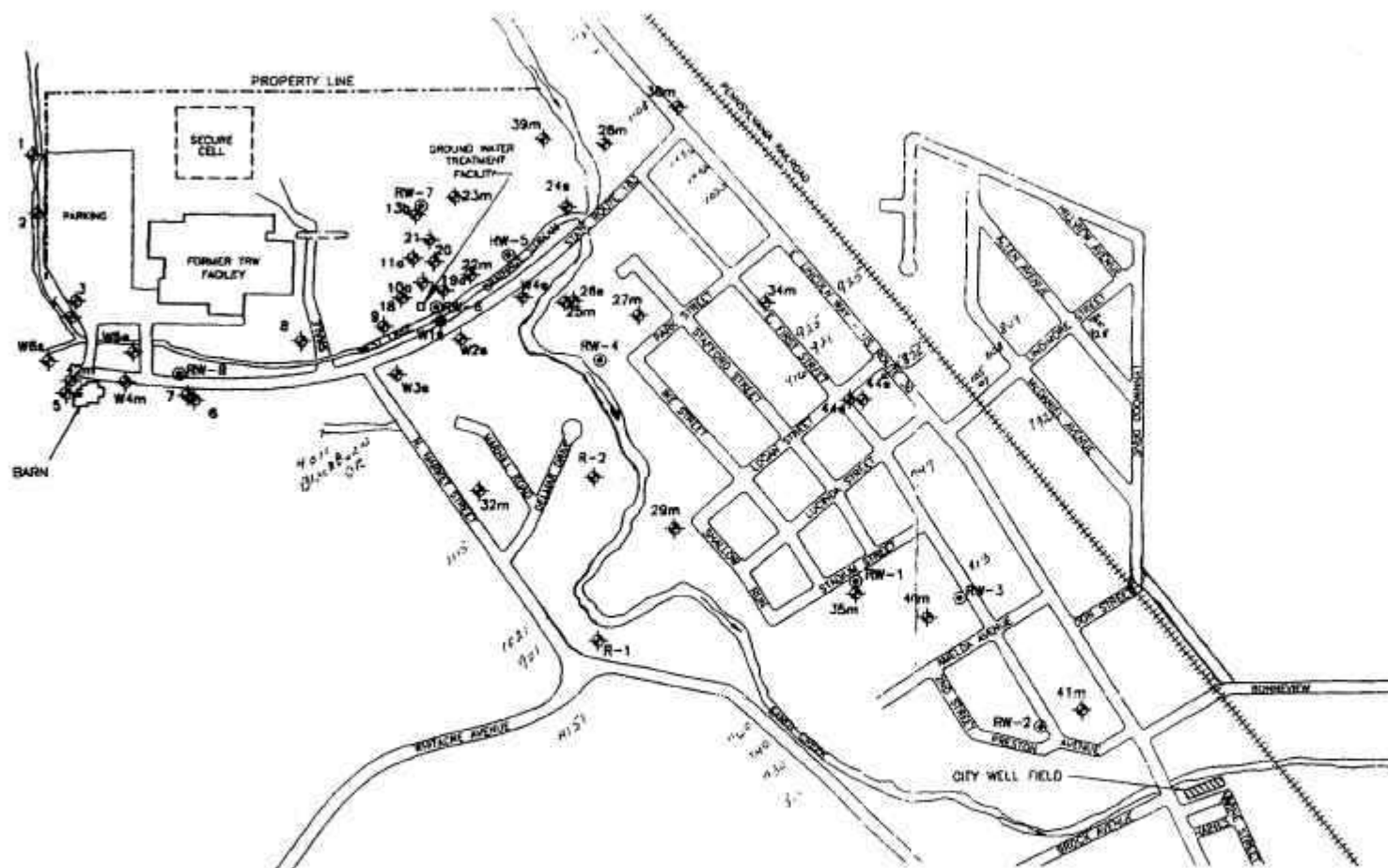
(From Clement Associates, Inc., June, 1992)





FIGURE 12

TRW INC.  
MINERVA, OHIO



LEGEND

- ✦ MONITORING WELL LOCATION
- ⊙ RECOVERY WELL LOCATION

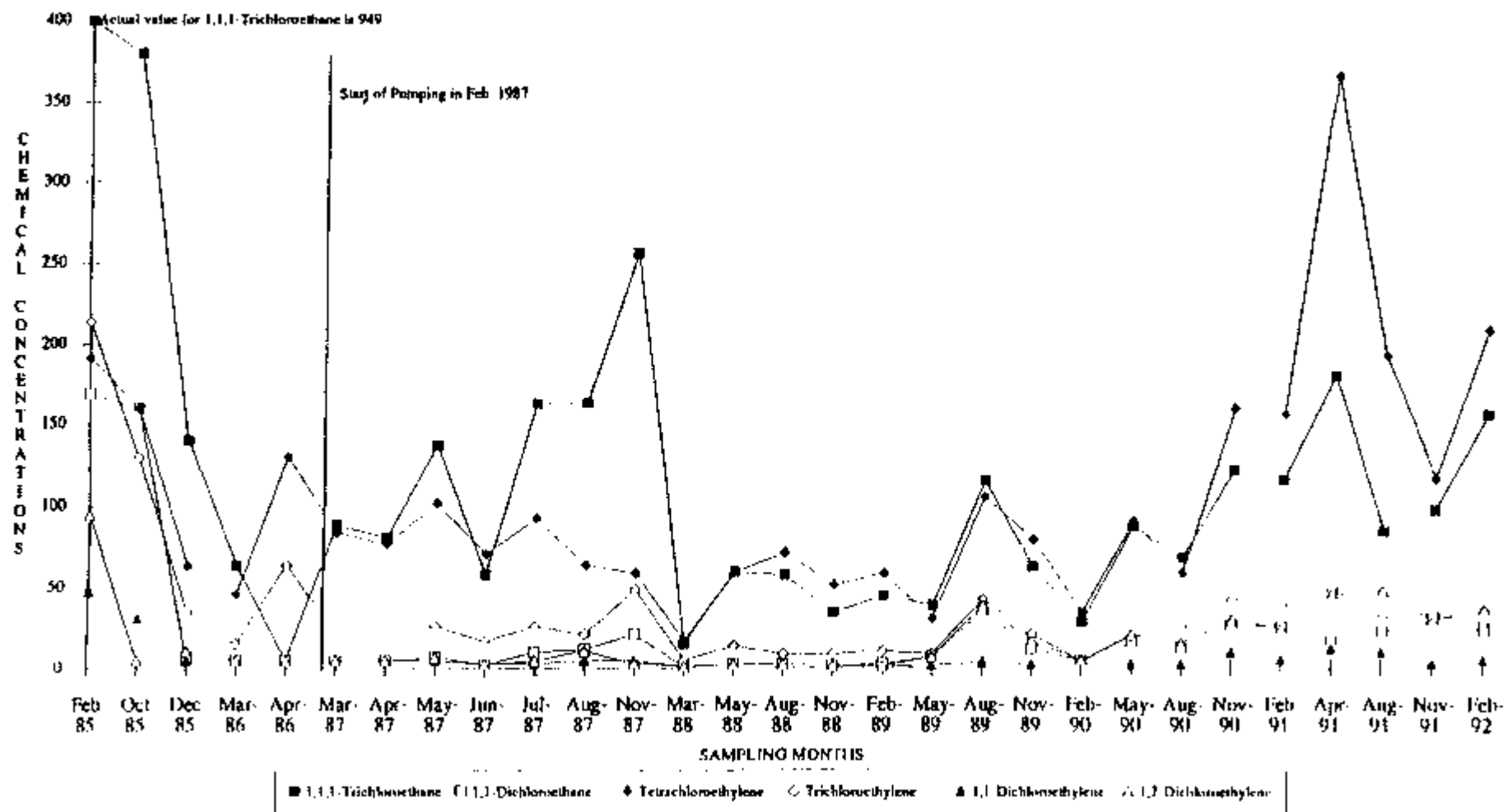
SITE MAP



2795.213.320

(Modified from O'Brien & Gere, June, 1992)

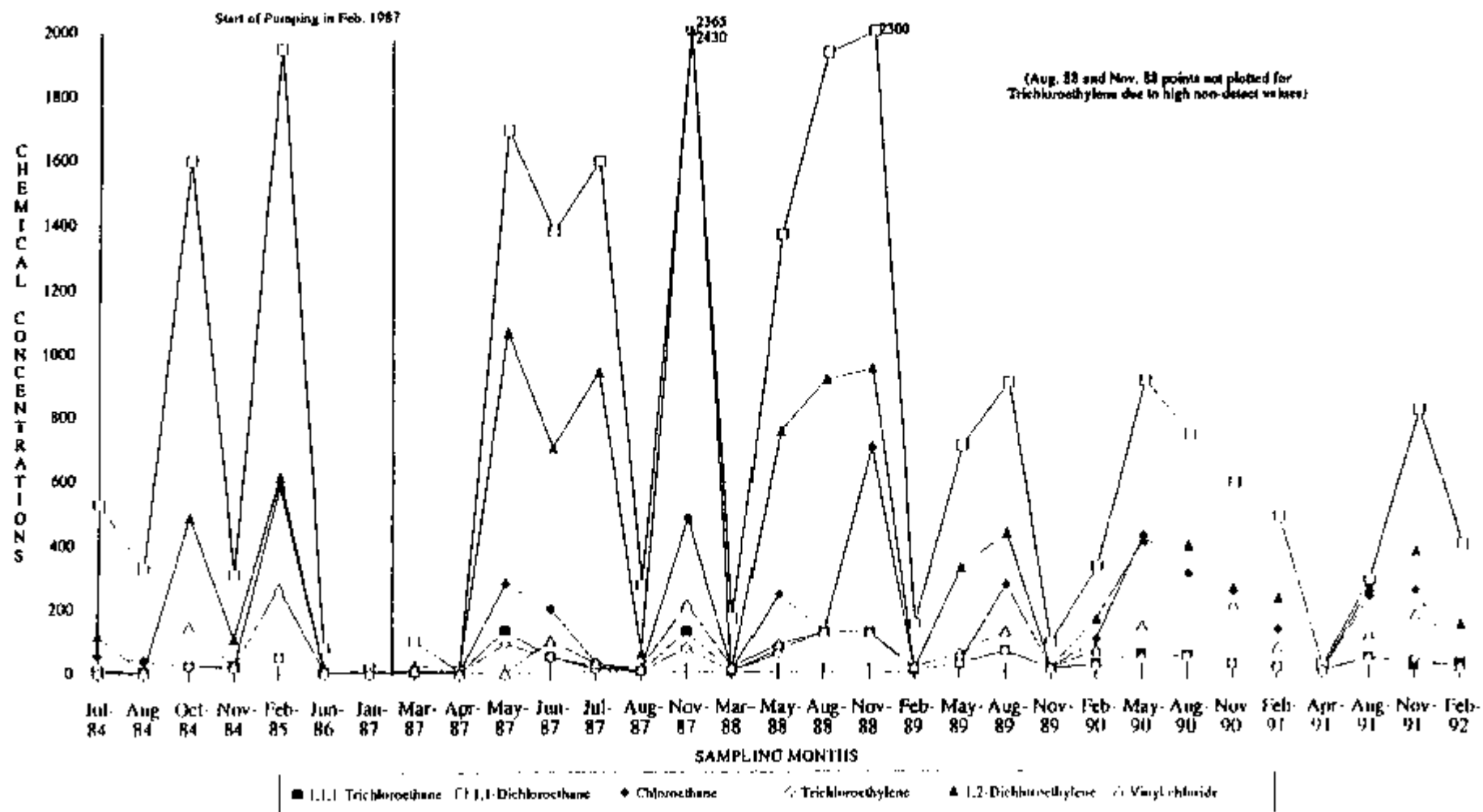
FIGURE 13  
ACL Compliance Point - Well W4m



(From Clement Associates, Inc., June, 1992)

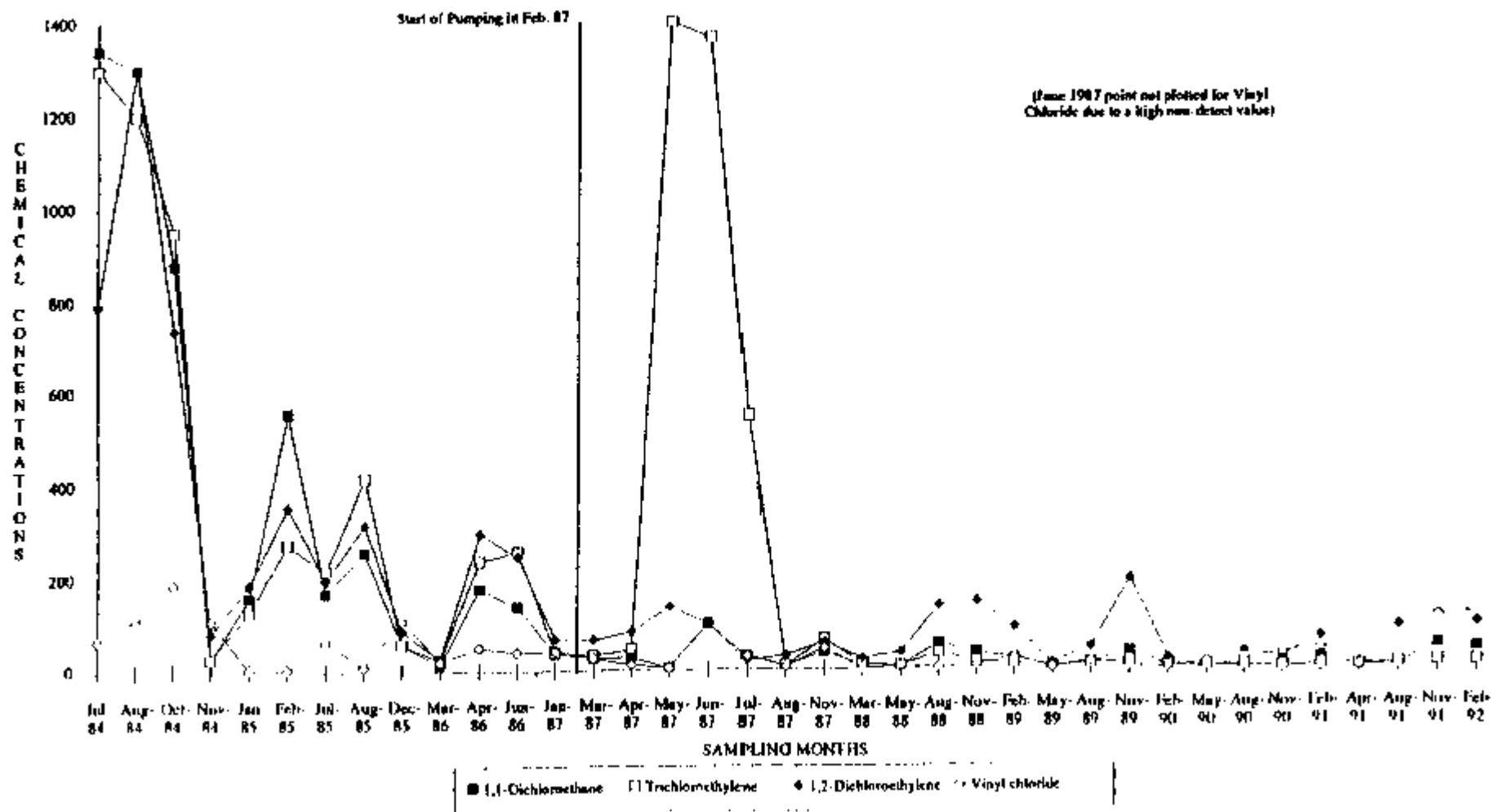
FIGURE 14

ACL Compliance Point - Well 13/13b



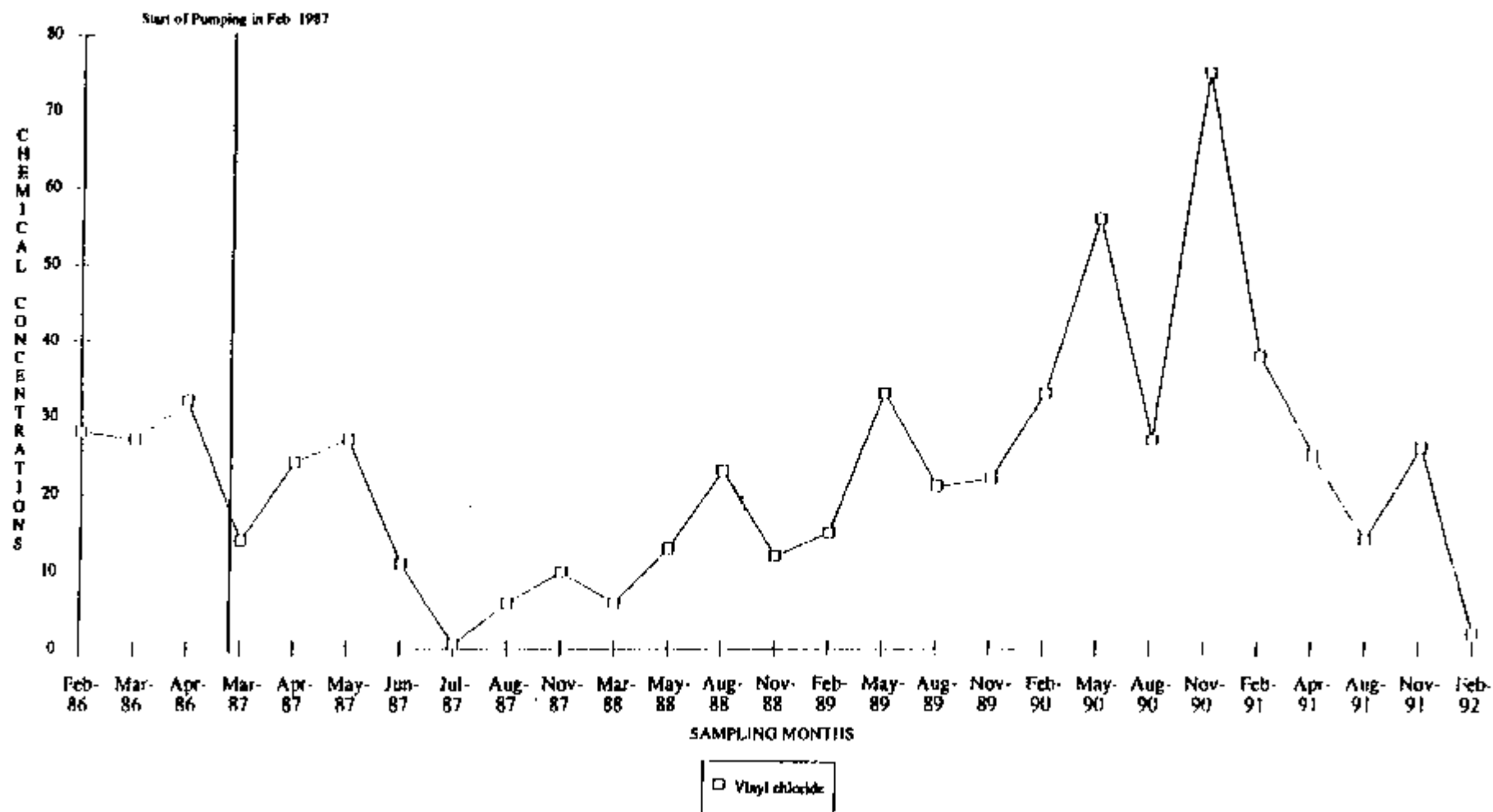
(From Clement Associates, Inc., June, 1992)

FIGURE 15  
ACL Compliance Point - Well 19a



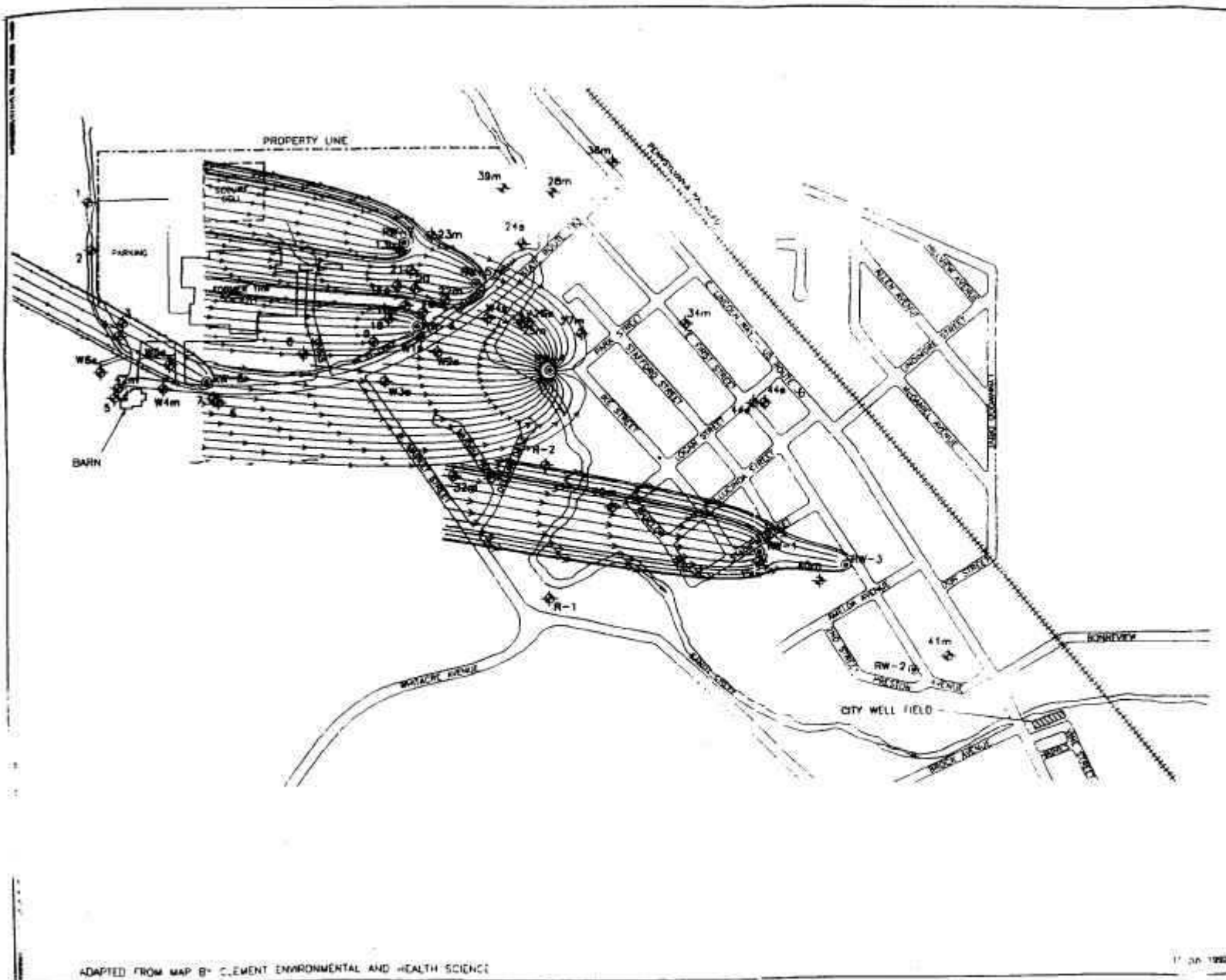
(From Clement Associates, Inc., June, 1992)

FIGURE 16  
ACL Compliance Point - Well 35m



(From Clement Associates, Inc., June, 1992)

FIGURE 17  
TRW INC.  
MINERVA, OHIO



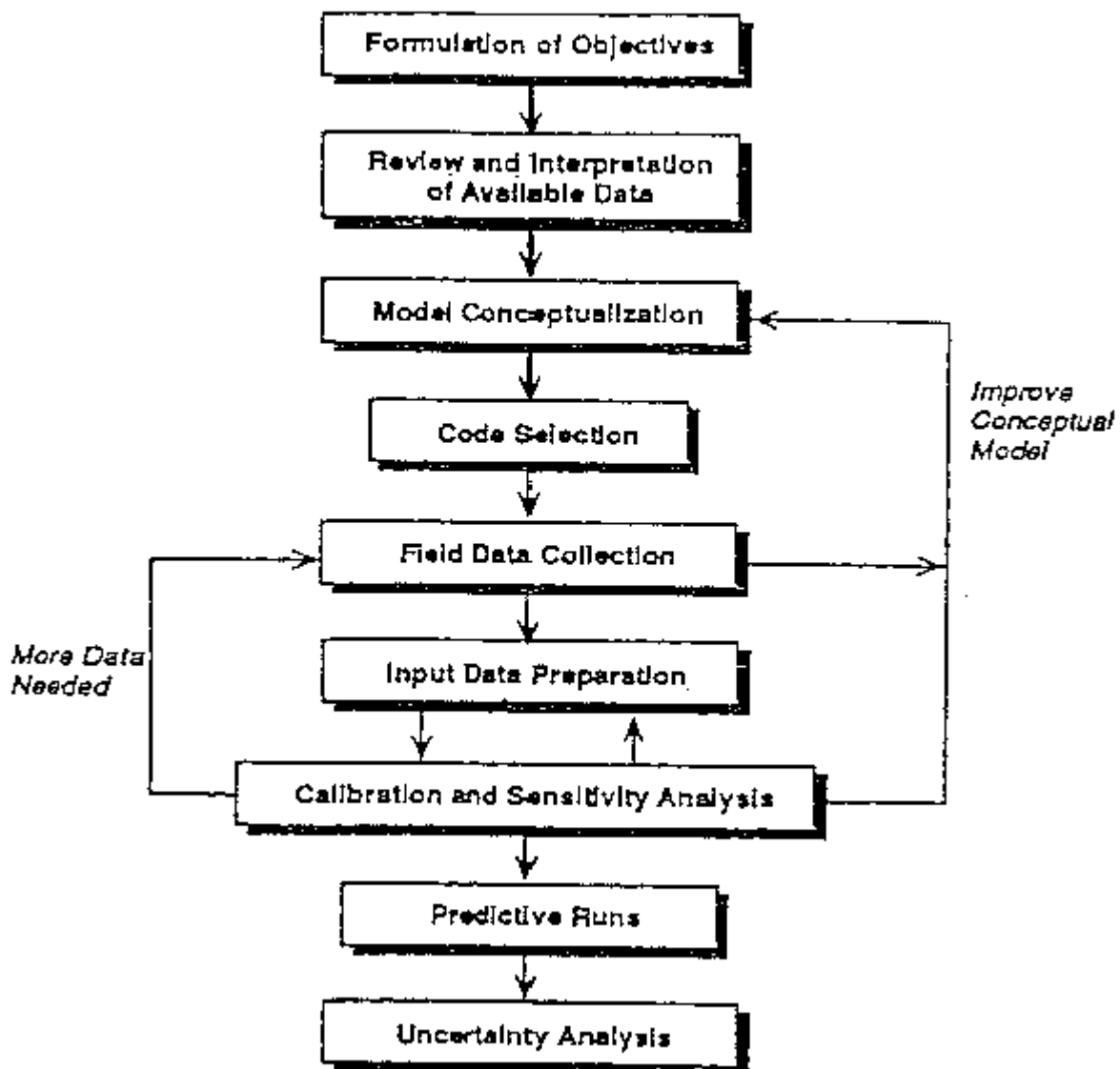


FIGURE 18 Flow Diagram for Development/Presentation of Ground Water Modeling Effort

(from Bear , J., M.S. Beljin, and R.R. Ross, 1992. Fundamentals of Ground-Water Modeling. U.S. EPA Ground Water Issue, Office of Research and Development, Office of Solid Waste and Emergency Response. EPA/540/S-92/005.)

## **TABLES**

**TABLE 1**

GROUNDWATER SAMPLING RESULTS  
(all concentrations are in parts per billion)

Well	1,1,1-TCA		1,1-DCA		CA		PCE		TCE		1,1-DCE		trans-1,2 DCE		VC		Number of Samples
	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	
Upgradient																	
1	ND <sup>a</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13
2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Central Area (South Property)																	
8	6	10	ND	ND	ND	ND	ND	ND	5	6	ND	ND	ND	ND	ND	ND	3
9	24	30	19	22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3
10/10A	--	(11)	170	290	ND	ND	ND	ND	117	160	--	(18)	254	500	12	52	14
11/11A	ND	ND	65	130	ND	ND	ND	ND	27	160	ND	ND	93	160	14	82	9
12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9	114	--	(18)	9
13	--	(12)	400	2000	56	610	ND	ND	--	(18)	ND	ND	93	640	73	235	7
14	ND	ND	ND	ND	ND	ND	ND	ND	7	15	ND	ND	15	30	ND	ND	5
18	ND	ND	175	790	335	1700	ND	ND	12	140	ND	ND	25	570	ND	ND	4
19/19A	--	(12)	203	1500	ND	ND	ND	ND	206	1300	11	350	237	1300	30	190	14
20	ND	ND	6	12	--	(45)	ND	ND	ND	ND	ND	ND	13	27	7	26	8
21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	17	45	12	62	5
22m	ND	ND	ND	ND	ND	ND	ND	ND	239	560	ND	ND	61	99	ND	ND	4
23m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	(1)	ND	ND	4
24s	ND	ND	ND	ND	ND	ND	ND	ND	--	(1)	ND	ND	ND	ND	ND	ND	5

(From Clement Associates, Inc., November, 1986)

TABLE 1 (continued)

Well Number	1,1,1-TCA		1,1-DCA		CA		PCE		TCE		1,1-DCE		trans-1,2 DCE		VC		Number of Samples
	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	
<u>Central Area (South Property)</u> continued																	
R1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4
R2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	5	3
W1s	--	(290)	ND	ND	ND	ND	ND	ND	16	86	--	(49)	6	22	--	(2)	4
W2s	ND	ND	--	(39)	ND	ND	ND	ND	14	120	ND	ND	--	(270)	ND	ND	4
W3s	3	13	18	28	ND	ND	ND	ND	--	(2)	--	(1)	4	5	8	13	5
W4s	ND	ND	ND	ND	ND	ND	ND	ND	295	470	ND	ND	58	170	--	(47)	5
32	--	(1)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	(1)	ND	ND	2
<u>Central Area (South of Sandy Creek)</u>																	
25m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	28	5
26s	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
27m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	(1)	19	25	2
34m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
<u>Southwest Area</u>																	
29m	--	(1)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	2	ND	ND	3
35m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	(1)	29	32	3
37m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	10	2
40m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	15	15	1
41m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	(1)	ND	ND	2
<u>Eastern Area</u>																	
28m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
36m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	(1)	ND	ND	2
39m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1

TABLE 1 (continued)

Well	1,1,1-TCA		1,1-DCA		CA		PCE		TCE		1,1-DCE		trans-1,2 DCE		VC		Number of Samples
Number	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	Geo. Mean	Max	
<u>Barn Area</u>																	
5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4
6	--	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3
7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
W5s	8	43	74	170	16	110	ND	ND	33	69	10	22	17	28	--	(1)	6
W6s	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
W4m	177	1000	32	260	ND	ND	115	230	76	240	16	76	17	98	ND	ND	6
42m	4	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2

<sup>a</sup>Detected at 1 ppb in one sample, 2 ppb in one sample

## NOTE:

- (1) A volatile organic scan (USEPA method 624) was performed on each sample. The table shows only positive results for tetrachloroethylene, trichloroethylene, 1,1,1-trichloroethane and their degradation products. Other compounds, believed to be the result of sample contamination (either field or laboratory) were occasionally detected and are listed in Appendix ED. Otherwise, compounds normally reported in the VOC scan, but not listed in the table were not detected (see text).
- (2) Geometric means were computed for all compounds detected in more than one sample, using one-half the detection limit for non-detect readings.
- (3) Values in parentheses indicate compounds detected in only one sample.

Key: 1,1,1-TCA = 1,1,1-trichloroethane  
1,1-DCA = 1,1-dichloroethane  
CA = chloroethane  
PCE = tetrachloroethylene  
TCE = trichloroethylene  
1,1-DCE = 1,1-dichloroethylene  
trans-1,2-DCE = trans-1,2-dichloroethylene  
VC = vinyl chloride  
ND = not detected  
-- = Mean not calculated where compound was detected in only one sample

**TABLE 2**RESIDENTIAL WELL SAMPLING<sup>a</sup>

Lot Number	Address	Resident	Date Sampled	Results (ppb) <sup>b</sup>
O.L. 86	1003 Stafford	Fry	11/11/85	ND
O.L. 86	1004 Stafford	Baxter	11/11/85	10 (VC)
563/564	820 E. Lincoln Way	Electronic Service	11/11/85	ND
586	1020 E. Lincoln Way	Betz	11/12/85	ND
587	1032 E. Lincoln Way	Haynam	11/11/85	ND
588	1036 E. Lincoln Way	Mason	11/11/85	ND
590	1108 E. Lincoln Way	Cowl	11/11/85 06/02/85	ND ND
595	1017 E. First	J. Clark	11/12/85 12/10/85	1 (VC) ND
603	1112 E. Lincoln Way	Bevington	11/11/85 12/10/85 01/09/86 05/29/86	2 (VC) 2 (VC) 1 (VC) 2 (VC)
604	1116 E. Lincoln Way	Betler	04/29/85 01/28/86 05/29/86	ND 1 (VC) ND
605	1118 E. Lincoln Way	Morgan	04/29/85 01/28/86	ND ND
624	925 E. First	Mutigli	11/11/85	ND
626	921 E. First	Stump	11/11/85	ND

**(From Clement Associates, Inc., November, 1986)**

TABLE 2 (continued)

RESIDENTIAL WELL SAMPLING<sup>a</sup> (continued)

Lot Number	Address	Resident	Date Sampled	Results (ppb) <sup>b</sup>
639	747 E. First	Thompson	11/11/85	ND
642	715 E. First*	Casale	11/11/85	ND
663	918 E. First	Davison	11/11/85	ND
668	928 E. First	Crowe	11/11/85	ND
822	817 Ike Street	Hodge	11/12/85 12/05/85	1.8 (VC) 9 (VC)
867	605 Logan	Giovanelli <sup>c</sup>	11/11/85  04/09/86	6 (DCA) 7 ( <u>trans</u> -1,2-DEC) 57 (VC) 5 (DCA) 5 ( <u>trans</u> -1,2-DCE) 15 (VC)
985	4150 Union	Perrin	9/11/84	ND
986	4144 Union	Wartluff	11/06/84  04/29/85	1 (DCA) 2 ( <u>trans</u> -1,2-DCE) 2 (TCE)
988	4134 Union	Grimes	09/11/84 11/06/84 12/05/84 04/29/85	ND ND ND T (TCE)

\*Resident claims to be on city water

**TABLE 2 (continued)**

RESIDENTIAL WELL SAMPLING<sup>a</sup> (continued)

Lot Number	Address	Resident	Date Sampled	Results (ppb) <sup>b</sup>
989	16424 Delmar	Brown	09/11/84 12/05/84	ND ND
990	16440 Delmar	Reed	11/06/84 04/29/85	ND ND
991	16464 Delmar	Miller	09/11/84 11/06/84 12/05/84 04/29/85	ND ND ND ND
992	16480 Delmar <sup>d</sup>	Mallernee	11/06/84	2 (DCA) 2 (TCA)
992	16484 Delmar <sup>d</sup>	Osborne	11/06/84 12/05/84 04/29/85	2 (DCA) 2 (TCA) 1 (DCA) 2 (TCA) ND
994	16492 Delmar	Jackson	12/05/84	2 (VC)
995/6/7	16516 Delmar <sup>e</sup>	Fry	09/11/84 11/01/84	ND 2 (VC)
998	16540 Delmar	Bush	09/11/84	ND
	16538 Delmar <sup>f</sup>	Crawford	11/06/84 12/05/84	8 (VC) 13 (VC)
999	16535 Delmar <sup>g</sup>	Criss/Steen	09/11/84 11/06/84 12/05/84	ND 9 (VC) 13 (VC)

TABLE 2 (continued)

RESIDENTIAL WELL SAMPLING<sup>a</sup> (continued)

Lot Number	Address	Resident	Date Sampled	Results (ppb) <sup>b</sup>
1000	16516 Delmar <sup>h</sup>	Dager	12/05/84	2 (VC)
	16517 Delmar <sup>h</sup>	Klug	11/01/84	11 (VC)
			12/05/84	16 (VC)
1001	4126-4124 Marihill	Niuman	09/11/84	ND
			11/01/84	2 (VC)
			12/05/84	9 (VC)
1002	4121 Marihill	D. Miller	09/11/84	ND
			04/29/84	ND
1003	4113 Marihill/ 4111 Marihill <sup>1</sup>	Eddy/ Phillips	09/11/84	1 ( <u>trans</u> -1,2-DCE)
			11/01/84	2 (VC)
			12/05/84	3 (VC)
1004	4100 Marihill	Baith	11/01/84	7 (VC)
			12/05/84	15 (VC)
1005	4090 Marihill	J. Steen	09/11/84	1 (DCA)
				2 ( <u>trans</u> -1,2-DCE)
			11/01/84	1 (DCA)
				2 ( <u>trans</u> -1,2-DCE)
				8 (VC)
			12/05/84	ND
1006/1007	4076 Marihill	Owens	Not Sampled:	Resident not home
1008	4066 Marihill	L. Steen	09/11/84	3 (DCA)
				3 ( <u>trans</u> -1,2-DCE)

TABLE 2 (continued)

RESIDENTIAL WELL SAMPLING<sup>a</sup> (continued)

Lot Number	Address	Resident	Date Sampled	Results (ppb) <sup>b</sup>
1008	(continued)		11/01/84	2 (DCA) 2 (trans-1,2-DCE) 12 (VC)
1015	4201 Union	Unkefer	11/11/85	ND
1021	1000 Stafford	Bolin	11/11/85	9 (VC)
			12/04/85	19 (VC)
1049	3616 Union	Koch	11/11/85	ND
--	4100 Union	Kail	09/11/84	ND
			11/06/84	ND
			04/29/85	ND
--	22142 State Route 30	Cobadesh	12/05/84	ND
--	3691 Union	C. Clark	11/11/85	ND
--	713 E. First	Welch	11/11/85	ND
--	22166 State Route 30	McCulley	01/22/86	2 ( <u>trans</u> -1,2-DCE)
--	4090 Whitacre	Hawk	12/04/85	ND
--	714 E. First	Koniecko	12/04/85	ND
--	4030 Whitacre	Gross	12/04/85	ND
--	4054 Whitacre	Kohl	01/09/86	ND
--	22134 State Route 30	Lewis	03/10/86	ND
			06/09/86	ND
--	732 McDaniel Ave	-	05/29/86	ND
--	730 Shallow Run	-	06/09/86	ND

**TABLE 2 (continued)**

NOTES:

- <sup>a</sup> All samples analyzed for volatile organics using USEPA method 524. Lot numbers 985, 988, 991, 995/6/7, 998, 999, 1001, 1002, 1003, 1008, 4201 Union and 4100 Union were analyzed for PCBs using USEPA Method 8080. No PCBs were detected at or above the detection limit of 1 ppb.
- <sup>b</sup> ND = none detected (detection limit of 1 ppb)  
VC = vinyl chloride (chloroethane)  
DCA = 1,1-Dichloroethane  
trans-1,2-DCE = trans-1,2-Dichloroethane  
TCE - trichloroethene  
TCA - trichloroethane  
T = trace, compound detected below method detection limit, but not quantifiable
- <sup>c</sup> Well water use only for pool and car washing. City water used for drinking
- <sup>d</sup> Duplex: 16480 and 16486 Delmar used the same well
- <sup>e</sup> Duplex: 16516 and 16496 Delmar used the same well
- <sup>f</sup> Duplex: 16540 and 16538 Delmar used the same well
- <sup>g</sup> Duplex: 16535 and 16537 Delmar used the same well
- <sup>h</sup> Duplex: 16517 and 16516 Delmar used the same well
- <sup>i</sup> Duplex: 4113 Marihill and 4111 Marihill used the same well

**TABLE 3**

May 6, 1994

**CURRENT RESIDENTIAL WELL USERS**

800 N. Market St., Everett Eltringham  
730 N. Market St., Kenneth Lewis, 216-868-3035  
740 N. Market St., ??  
760 N. Market St., Gomer Jenkins, 216-868-4705  
\*901 N. Market St., Wendell Smith, 216-868-4682  
\*1021 N. Market St., Tim Blackburn, 8005 Stump Rd. Minerva, 216-868-6229  
1115 N. Market St., Homer Unkefer, 216-868-6419  
\*4151 Whitacre Ave., S.E., Edward Libby, 216-868-6552  
4011 Blackburn Dr., James Blackburn, 216-868-3629  
713 E. First St., Ruth Welch Estate  
747 E. First St., Mrs. Virginia Thompson,  
921 E. First St., Earl Stump  
925 E. First St., Don-Mutigili, 216-868-6610  
916 E. First St., Edward Davison, 216-868-4434  
105 & 107 Lindimore St., Frank Simmons, 405 McDowell, Minerva, 216-868-4442  
300 Lindimore St., Carl Comsia, 216-868-6113  
732 McDaniel Ave., Alice I Rocco, 216-868-5353  
808 McDaniel Ave., Lee F. McGrew, 216-868-4474  
809 McDaniel Ave., Richard Wickersham, 216-868-4091  
728 Allen Ave., William Reckner, 216-868-5561  
820 E. Lincoln Way, Electronic Service, 216-868-4264 This is commercial  
925 E. Lincoln Way, William Palmer, 917 E. Lincoln Way, Minerva, 216-868-5303  
1020 E. Lincoln Way, Kenneth Blevins, 216-868-3422  
1032 E. Lincoln Way, Gordon Isenhour, 216-868-6374  
1036 E. Lincoln Way, Daniel Mason, 216-868-4069  
1108 E. Lincoln Way, Joseph Crowl, 216-868-5531  
1116 E. Lincoln Way, Raymond Betler, 216-868-3158  
1118 E. Lincoln Way, Lynn Morgan, 216-868-6911

\* Out of Corporation Limits

**TABLE 4**  
**ALTERNATE CONCENTRATION LIMITS (ACLs)**  
**TRW SITE, MINERVA, OHIO**

	On-Site Compliance Points (Note 1) (ppb)	Off-Site Compliance Points (Note 2) (ppb)	Maximum Contaminant Levels (MCLs)
Tetrachloroethylene	90	NA	5
Trichloroethylene	420	NA	5
1,1-Dichloroethylene	8	NA	7
<u>trans</u> -1,2-Dichloroethylene	9,330	NA	100
Vinyl Chloride	2	1	2
1,1,1-Trichloroethane	26,670	NA	200
1,1-Dichloroethane	112,000	NA	--
Chloroethene	240,000	NA	--

NA - Not Applicable, compound not detected off-site.

Note 1 - "On-site Compliance Points" are wells 13, 19a, W4m and 24s

Note 2 - "Off-site Compliance Points" are wells 34m, 35m, 41m, 44s and 44d

(Modified from Clement Associates, Inc., June, 1992)

TABLE 5

PREDICTED GROUNDWATER CONCENTRATIONS 1 YEAR,  
5 YEARS, AND 10 YEARS INTO REMEDIATION (a)

(All concentrations in ppb)

ACL Compliance Point	Initial Concentration (b)	1 Year	5 Years	10 Years
W4m:				
Tetrachloroethylene	230	190	25	5
Trichloroethylene	240	200	25	5
1,1-Dichloroethylene	76	60	10	2
<u>trans</u> -1,2-Dichloroethylene	98	80	10	2
1,1,1-Trichloroethane	1,000	820	100	20
1,1-Dichloroethane	210	30	30	< 1
19a:				
Trichloroethylene	1,300	1,050	35	8
1,1-Dichloroethylene	350	280	10	2
<u>trans</u> -1,2-Dichloroethylene	1,300	1,050	35	8
Vinyl chloride	150	150	4	1
1,1-Dichloroethane	1,500	1,210	40	9
13:				
<u>trans</u> -1,2-Dichloroethylene	640	530	80	20
Vinyl chloride	235	190	30	6
1,1-Dichloroethylene	2,000	1,650	240	50
Chloroethane	610	500	70	20
24s, ND	< 1	< 1	< 1	< 1
35m, Vinyl Chloride	32	30	25	17
34m, ND	< 1	< 1	< 1	< 1
41m	< 1	< 1	< 1	< 1
44s	(c)	< 1	< 1	< 1
44d	(c)	< 1	< 1	< 1

(a) Concentrations are accurate within a factor of 2.

(b) Maximum contaminant concentrations detected in each well at the time of the supplemental feasibility study.

(c) No data available; wells were proposed at the time of the predictions.

ND = None detected.

(From Clement Associates, Inc., June, 1992)

TABLE 6  
GROUNDWATER QUALITY DATA  
TRW INC.  
MINERVA, OHIO

WELL NO.		SAMPLING DATE	1,1,1-TCA	1,1-DCA	CHLORO-ETHANE	PCE	TCE	1,1-DCE	1,2-DCE	VINYL CHLORIDE	TOTAL VOCs
1		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2/11/92	Dry								
2		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2/11/92	Dry								
3		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2/12/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
4		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
5		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2/12/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
6		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2/12/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
7		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
8		1986 (1)	6	ND	ND	ND	5	ND	ND	ND	11
		5/2/91	1	1	ND	ND	ND	ND	ND	ND	2
		2/11/92	Dry								
9		1986 (1)	24	19	ND	ND	ND	ND	ND	ND	43
		5/2/91	ND	1	ND	ND	ND	ND	ND	ND	1
		2/11/92	Dry								
10a		1986 (1)	ND	170	ND	ND	117	ND	254	12	553
		5/2/91	ND	8	ND	ND	22	ND	20	ND	50
		2/11/92	Dry								
11a		1986 (1)	ND	65	ND	ND	27	ND	93	14	199
13		1986 (1)	ND	400	56	ND	ND	ND	93	73	622
13b (2)		11/7/90	ND	590	250	ND	ND	262	ND	209	1311
13b (2)	Rep 1	2/11/92	22	390	ND	ND	ND	ND	150	ND	562
13b (2)	Rep 2	2/11/92	28	410	ND	ND	ND	ND	150	ND	588
13b (2)	Rep 3	2/11/92	24	390	ND	ND	ND	ND	140	ND	554
	1992	average	25	397					147		568

(From O'Brien & Gere, June, 1992)

TABLE 6 (continued)  
**GROUNDWATER QUALITY DATA**  
**TRW INC.**  
**MINERVA, OHIO**

WELL NO.		SAMPLING DATE	1,1,1-TCA	1,1-DCA	CHLORO-ETHANE	PCE	TCE	1,1-DCE	1,2-DCE	VINYL CHLORIDE	TOTAL VOCs
18		1986 (1)	ND	175	335	ND	12	ND	25	ND	547
19a		1986 (1)	ND	203	ND	ND	206	11	237	30	687
	Rep 1	2/11/92	ND	39	ND	ND	15	ND	99	12	165
	Rep 2	2/11/92	ND	37	ND	ND	11	ND	86	19	153
	Rep 3	2/11/92	ND	47	ND	ND	13	ND	98	28	186
	1992	average		41			13		94	20	168
20		1986 (1)	ND	6	ND	ND	ND	ND	13	7	26
21		1986 (1)	ND	ND	ND	ND	ND	ND	17	12	29
22m		1986 (1)	ND	ND	ND	ND	239	ND	61	ND	300
23m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2/12/92	ND	8	ND	ND	ND	ND	5	13	26
24s		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Rep 1	2/11/92	ND	ND	ND	1	ND	ND	ND	ND	1
	Rep 2	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Rep 3	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1992	average									<1
25m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	6	6
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2/12/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
26s		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
27m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	19	19
		5/2/91	ND	ND	ND	ND	ND	ND	ND	11	11
		2/12/92	ND	ND	ND	ND	ND	ND	ND	4	4
28m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2/12/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
29m		1986 (1)	ND	ND	ND	ND	ND	ND	2	ND	2
		5/2/91	ND	ND	ND	ND	ND	ND	1	ND	1
		2/12/92	ND	ND	ND	ND	ND	ND	2	ND	2

TABLE 6 (continued)  
GROUNDWATER QUALITY DATA  
TRW INC.  
MINERVA, OHIO

WELL NO.		SAMPLING DATE	1,1,1-TCA	1,1-DCA	CHLORO-ETHANE	PCE	TCE	1,1-DCE	1,2-DCE	VINYL CHLORIDE	TOTAL VOCs
32m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2/12/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DUP.	2/12/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
34m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Rep 1	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Rep 2	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Rep 3	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1992	average									ND
35m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	29	29
	Rep 1	2/11/92	ND	ND	ND	ND	ND	ND	ND	3	3
	Rep 2	2/11/92	ND	ND	ND	ND	ND	ND	ND	3	3
	Rep 3	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1992	average									2
36m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
39m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
40m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	15	15
		5/2/91	ND	ND	ND	ND	ND	ND	ND	22	22
		2/12/92	ND	ND	ND	ND	ND	ND	ND	14	14
41m		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Rep 1	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Rep 2	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Rep 3	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1992	average									ND
42m		1986 (1)	4	ND	ND	ND	ND	ND	ND	ND	4
44s	Rep 1	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Rep 2	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Rep 3	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1992	average									ND
44d	Rep 1	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Rep 2	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Rep 3	2/11/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1992	average									ND

TABLE 6 (continued)  
GROUNDWATER QUALITY DATA  
TRW INC.  
MINERVA, OHIO

WELL NO.		SAMPLING DATE	1,1,1-TCA	1,1-DCA	CHLORO-ETHANE	PCE	TCE	1,1-DCE	1,2-DCE	VINYL CHLORIDE	TOTAL VOCs
W1s		1986 (1)	ND	ND	ND	ND	16	ND	6	ND	22
W2s		1986 (1)	ND	ND	ND	ND	14	ND	ND	ND	14
W2s		5/2/91	ND	150	ND	ND	280	ND	910	ND	1,340
W2s		2/12/92	ND	730	ND	ND	410	ND	2,700	ND	3,840
W3s		1986 (1)	3	18	ND	ND	ND	ND	4	8	33
W3s		5/2/91	ND	8	ND	ND	ND	ND	ND	3	11
W3s		2/12/92	ND	15	ND	ND	ND	ND	2	4	21
W4s		1986 (1)	ND	ND	ND	ND	295	ND	58	ND	353
W4s		5/2/91	ND	ND	ND	ND	360	ND	ND	ND	360
W4s		2/12/92	ND	ND	ND	ND	27	ND	120	14	161
W4m		1986 (1)	177	32	ND	115	76	16	17	ND	433
W4m		5/2/91	NA	NA	NA	NA	NA	NA	NA	NA	NA
W4m	Rep 1	2/11/92	140	22	ND	180	24	ND	31	ND	397
W4m	Rep 2	2/11/92	130	21	ND	280	32	ND	43	ND	506
W4m	Rep 3	2/11/92	210	27	ND	180	28	ND	39	ND	484
	1992	average	160	23		213	28		38		462
W5s		1986 (1)	8	74	16	ND	33	10	17	ND	158
W6s		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
R-1		1986 (1)	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/2/91	ND	ND	ND	ND	ND	ND	ND	ND	ND
		5/7/92	ND	ND	ND	ND	ND	ND	ND	ND	ND
R-2		1986 (1)	ND	ND	ND	ND	ND	ND	ND	4	4
		5/2/91	ND	ND	ND	ND	ND	ND	ND	84	84
		5/7/92	ND	2	ND	ND	ND	ND	3	38	43

NOTES. All values reported in parts per billion (ppb)

1,1,1-TCA - 1,1,1-Trichloroethane

1,1-DCA - 1,1-Dichloroethane

PCE - Tetrachloroethene

1,1-DCE - 1,1-Dichloroethene

1,2-DCE - 1,2-Dichloroethene

NA - Not analyzed

ND - Not detected

(1) Concentration is the geometric mean of data collected prior to system start-up.

(2) Well 13b was sampled because Well 13 was dry.

**TABLE 7**  
**TRW - MINERVA**  
**GROUND WATER DATA**  
**MAY 1, 1992 TO AUGUST 3, 1994**

Well No.	Sampling Date	1,1,1-TCA	1,1-DCA	Chloroethane	PCE	TCE	1,1-DCE	1,2-DCE	VC
W4m	05/01/92	106	< 50	< 50	218	< 50	< 50	< 50	< 50
	08/12/92	119	< 25	< 25	202	43	< 25	48	< 25
	02/04/93	52	< 20	< 20	153	23	< 20	29	< 20
	05/12/93	71	6	< 10	153	26	< 10	32	< 10
	08/11/93	75	< 20	< 20	286	40	< 20	62	< 20
	11/10/93	51	< 10	< 10	137	26	< 10	24	< 10
	02/03/94	36	< 10	< 10	150	13	< 10	< 10	< 10
	05/13/94	43	< 20	< 20	209	< 20	< 20	22	< 20
	08/03/94	84	34	< 20	281	41	< 20	61	< 20
19a	05/01/92	< 10	< 10	< 10	< 10	< 10	< 10	47	< 10
	08/12/92	< 10	24	< 10	< 10	< 10	< 10	81	55
	02/04/93	< 5	12	< 5	< 5	< 5	< 5	76	19
	05/12/93	< 2.5	7.1	< 2.5	< 2.5	2.7	< 2.5	21	39
	08/11/93	< 10	20	< 10	< 10	< 10	< 10	58	72
	11/10/93	< 5	26	< 5	< 5	< 5	< 5	39	87
	02/03/94	< 1	< 1	< 1	< 1	< 1	< 1	<1	< 1
	05/13/94	< 2.5	19	< 2.5	< 2.5	< 2.5	< 2.5	34	34
	08/03/94	< 2.5	21	< 2.5	< 2.5	< 2.5	< 2.5	29	28

**TABLE 8**  
**TRW INC.**  
**MINERVA, OHIO**  
**ACTUAL VS. PREDICTED VOC CONCENTRATIONS**  
**5 YEARS INTO REMEDIATION**

ACL COMPLIANCE POINT	COMPOUND	INITIAL CONCENTRATION <sup>(a)</sup>	PREDICTED CONCENTRATION FOLLOWING 5 YEARS OF REMEDIATION <sup>(b)</sup>	ACTUAL CONCENTRATION (2/12/92) <sup>(c)</sup>	ACTUAL CONCENTRATION (8/3/94)
<b>W4m</b>	Tetrachloroethylene	230	25	213	281
	Trichloroethylene	240	25	28	41
	1,1-Dichloroethylene	76	10	<10	<20
	t-1,2-Dichloroethylene	98	10	38	61
	1,1,1-Trichloroethane	1000	100	160	84
	1,1-Dichloroethane	210	30	23	34
	<b>TOTAL</b>	1854	200	462	501
<b>13<sup>(d)</sup></b>	t-1,2-Dichloroethylene	640	80	147	173
	Vinyl Chloride	235	30	<20	<50
	1,1-Dichloroethane	2000	240	397	330
	Chloroethane	610	70	<20	161
	1,1,1,-Trichloroethane	12	--- <sup>(e)</sup>	25	<50
	<b>TOTAL</b>	3485	420	568	664
<b>19a</b>	Trichloroethylene	1300	35	13	<2.5
	1,1-Dichloroethylene	350	10	<5	<2.5
	t- 1,2-Dichloroethylene	1300	35	94	29
	Vinyl Chloride	150	4	20	28
	1,1-Dichloroethane	1500	40	41	21
	<b>TOTAL</b>	4600	124	168	78
<b>24s</b>	ND	<1	<1	<1	<1
<b>34m</b>	ND	<1	<1	<1	<1
<b>35m</b>	Vinyl Chloride	32	25	2	7.4
<b>41m</b>	ND	<1	<1	<1	<1
<b>44s</b>		<sup>(f)</sup>	<sup>(f)</sup>	<1	<1
<b>44d</b>		<sup>(f)</sup>	<sup>(f)</sup>	<1	<1

(Modified from O'Brien & Gere, June, 1992)

**TABLE 8**  
**(continued)**

Note: All concentrations in ppb.

ND - None Detected.

- (a)- Initial concentration is the maximum concentration detected during background monitoring conducted from June 1984 to April 1986 as presented by Clement Associates, Inc. in the Supplemental Ground Water Feasibility Study (1986) on Table 7-5.
- (b)- Concentrations were predicted from modeling completed by Clement Associates, Inc. and presented in the Supplemental Ground Water Feasibility Study (1986) on Table 7-5.
- (c)- 1992 concentrations are the average of three replicate samples collected on one date.
- (d)- The initial concentration of 12 ppb was detected in well 13. Well 13b has been used as a replacement for this well. Data presented for 2/12/92 are for well 13b.
- (e)- 1,1,1-Trichloroethane concentrations were not predicted by Clement Associates, Inc. as part of their modeling effort.
- (f)- These wells did not yet exist when modeling was conducted by Clement Associates, Inc.